1: Longrigg G-4, 5 (ca. 1915-1940) MH1 Iraq MH1

241 advantage of extensive fertile tracts and abundant water, it made [312] but a poor showing in the exports it permitted, and the low standard of life it sustained. It was, and is, possible indeed to exaggerate the potentialities of 'Iraq agriculture;[1] areas cultivable by flow or lift-irrigation are not unlimited;[2] even with the best of conservation, its river-water resources can never suffice, at one time, for all or nearly all its irrigable lands; and the rains[3] upon which northern 'Iraq wholly depends are capricious and rarely sufficient. Barrage-irrigation could never be as easily achieved as in Egypt, and its cost must always place at a disadvantage, against a Canada or a Russia, countries which like central 'Iraq are dependent on it. The indigenous 'Moroccan' and the invading 'Najdi' locust were an annual menace to crops. The 'Iraqi *fallaḥ*, even when helped by a large measure of mechanization, was and is no match for the European or North American as a producer.

511 In the 'Iraq of 1900, at any rate, there were reasons enough for agricultural, and therefore universal, poverty. Conditions were tolerable in the rain-fed areas of Mosul and Shahrizur, where village organization prevailed, taxation was reasonable, the dangers of flooding unknown, land-holdings often small and personal: tolerable, too, on other lines, in the Shaṭṭ al-'Arab date-belt where security was good, society well rooted, and the growers' skill highly developed. If even in these two zones a lifetime of debt and near-starvation were the lot of most men, elsewhere, throughout lower 'Iraq, neither the social structure nor Government measures towards land settlement had produced conditions within which progress was possible. Security was habitually threatened over great areas by the aggression of neighbours or the depredations of the *badu* and their hungry camels. Even where tenure was reasonably secure, the prevalent crop-sharing system supplied but the barest living to the cultivator: the shaykhs and their agents, absentee landlords, and a blindly grasping Government combined to remove both the reward of past and the incentive for future toil. No shaykh and no landlord conceived a duty of improving productivity; wherever local agriculture called for combined and organized effort—silt-clearing, flood-bank protection, locust warfare, drainage—they provided no capital, no superior guidance, little co-ordination, no sense of social obligation. Government

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[1] It may be that, even in the legendary past, agricultural prosperity was somewhat less than is vaunted: the rains were no more copious, floods as ruinous, the swamps as vast, the *badu* as rapacious; and the great canals, to judge by the lack of surviving ruined headworks, may have been, after all, only flood-channels annually silt-cleared.

[311] [2] Some 20 million acres in irrigable areas (south and central 'Iraq), 10 million of rain-lands in the north.

[3] The annual average for Mosul area is some 450 mm., and more in the hills: in central 'Iraq, 150 mm.

1: Longrigg G-4, 5 (ca. 1915-1940) MH1 Iraq MH1

itself had rarely the knowledge, the physical control or the resources to initiate new methods or improve the old.

The cultivators themselves, mediocre in physique and discouraged by their circumstances, were resigned to accept the lowest subsistence level as the best which life could afford them. Their cultivation methods remained primitive. They had, indeed, their technique of small-scale water control, their wasteful but practicable methods of water-lift. They could be prompt to benefit from occasional rain or the wet silt of shrinking rivers, had mastered from early childhood their simplest of equipment. But there was no improvement in the quality of the few crop varieties grown, no experiment in new techniques, no ambition for purer seed-types which could have doubled the merchants' prices, no reluctance to offer adulterated or uncleaned produce. There was a dead or deadly conservatism, backed by centuries of habit and dull fatalism. Only on the Saniya estates were there signs that other standards might, without miracle, be achieved; with better security due to a favoured use of the *Zaptié*, modern buildings, regular silt-clearance, a minimum of helpful organization and financing, the Saniya lands offered a spectacle less mournful than the generality of 'Iraq agriculture—but had solved none of its major problems.

Of these, some were evident enough: problems of security both of tenure and of life, of the means to perform the communal functions of the countryside, of finance, of rural education, of taxation, and rent. Of the irrigation problem, vital to 'Iraq society and economics in every age, more must be said. 'Iraq, from this viewpoint, offered not only high hopes but grave difficulties, which in 1900 no attempt had been made to master. It was the chief of these that the Two Rivers vary more than tenfold seasonally in their discharge, whereby the beds sufficient for their discharge in the dry months are wholly inadequate to take their flood waters. The result must be wholesale flooding; and indeed great areas of land in central 'Iraq are below the high flood-level of the rivers. Secondly, the April flood season, when alone the river-levels have 'command' of riverain lands, begins too late to mature the spring grain crops, and ends before the ripening of the summer grains and vegetables. The basic requirements, therefore, were and are evidently five: protection against ruinous spring flooding: storage of flood water, for re-use in the low season: establishment of barrages to maintain river levels which will secure command by flow-canals at essential seasons: control of the canal-heads by regulators; and, finally, provision for main as well as local drainage, to prevent the otherwise inevitable and actually widespread salination.

1: Longrigg G-4, 5 (ca. 1915-1940) MH1 Iraq MH1

312 185 Although by 1900 these conditions were not unrealized either in Baghdad or Istanbul, they had not been formulated as connected problems for solution. Governmental activity in this sphere had consisted, at the caprice of Pashas, in no more than some measure of organization of petty local works. The Administration had in fact neither the knowledge nor control nor finance necessary to formulate or organize a comprehensive irrigation system. Heedless alike of present evils and of rich possibilities, the governors of 'Iraq were doing and planning nothing while irrigation in Egypt and India was making great and fruitful progress. Nor was the contribution of the public more promising; the shiftless tribal cultivators carried out with low efficiency such minimum of silt-clearance and flood-dyke repairs as was forced upon them, erected temporary canal-heads of reed-bundles or brushwood, multiplied their primeval devices of water-lift, wastefully prolonged or resited their canals, and ruined area after area with neglected salting.

An outstanding case of deterioration in irrigation conditions was occurring in these years on the middle Euphrates. Up to 1880 the Ḥilla branch had been maintained as the principal waterway, the Hindiya branch being a canal deriving from it. But the closing of the Ṣaqlawiya head up-stream, and the operation of natural forces of silting and scouring, allowed the Hindiya branch to gain in width and discharge. The problem of maintaining the flow of the Ḥilla branch had become first critically difficult and finally impossible. French engineers in 1891 completed a masonry dam which still held precariously in 1900, but failed to arrest the increasing ruin of Ḥilla branch irrigation.

487 The ancient land routes of the territory had remained constant since many centuries. Camel caravans used the desert ways of Damascus and Aleppo, mule-trains the time-worn hill tracks into Luristan, Kirmanshah, Persian Kurdistan, and the Van wilaya.

491 Within 'Iraq the routes were fixed by custom based on convenience; but here there were signs of recent progress in the provision of wayside Khans, new toll-bridges of stone or brick or resting on fragile pontoons. The roads, varying by districts in surface and security, were everywhere unsurfaced and neglected, deep in summer dust or flooded to seas of mud by rain or the overflow of canals.

499 Railways had, for many years, been hailed from a distance by 'Iraqis of every class as the bringers of ease and progress, and schemes in plenty had been propounded—those of Chesney in the eighteen-thirties, of Andrew in the 'fifties, and later of the Austrian von Pressel, the Italian Tonetti, the Frenchman Cottard, the Russian Kapnist. A local company had been formed in the 'eighties to construct a Khaniqin–Baghdad line, which lack of

1: Longrigg G-4, 5 (ca. 1915-1940) MH1 Iraq MH1

505 Privy Purse to an organization of the central Government, the Ottoman River (Nahriya) Administration; but the service deteriorated in spite of new and important units acquired in 1912, the *Basra* and the *Baghdad*. Negotiations for a merger between Lynch and the Nahriya were persistent after 1909, but were long delayed by strong hostile outcry, both locally and in Istanbul, against such an example of foreign dominance, and were incomplete on the outbreak of war.

505 648x The subject, indeed, was among those covered by the never-ratified Anglo-Turkish Agreement of May 1913. This provided that, in the interests of the steamers, no 'navigable streams' were to be diverted from their courses; navigation rights were to be awarded for sixty years to a new Ottoman River Navigation Company, to be formed upon a basis of equal participation by Turkish and British interests. A fourth steamer (but under the Turkish flag) was to be allowed to the Euphrates Company. But while this arrangement was acceptable to the Baghdad Railway Company, which guaranteed the new Company a high minimum of tonnage, the damage to Lynch interests was clear. This in turn was met by a further agreement of March 1914 which was to bring the Lynch interest itself into the Ottoman Navigation Company. The Railway's rights of port-construction at Basra were to be passed to an Ottoman Port Company with participation for each of Lynch, Lord Inchcape, and the British India interests, and the Baghdad Railway. World events, however, were to prevent any of these arrangements from coming into force; before the end of 1914 German and Turkish interest in Tigris steam navigation was for ever extinguished.

Meanwhile, the immediate task of moving the Baghdad Railway materials from Basra led to the formation in 1912 of an *ad hoc* company, the Société de Transports Fluviaux en Orient, with equal participation of the Lynch Company and the Deutsche Bank; it acquired suitable small craft for its purposes, and was controlled locally by the Euphrates and Tigris management.

312 In the all-important sphere of irrigation, the new century was to see great and promising developments. The year 1900 and succeeding years found, indeed, the same evils as ever flourishing unchecked: disastrous annual flooding, deficiency of irrigation water in the season of greatest need, lack of control, lack of drainage. The same helplessness of the unled and unrecognized cultivators, the same archaic methods, the same vague and abortive projects formed in high circles, continued to provide no practical cure. Conditions in the mid-Euphrates area turned from bad to worse, with lands abandoned, canals drying, and tribes fighting for existence. The Hindiya Barrage again partially collapsed in 1903

1: Longrigg G-4, 5 (ca. 1915-1940) MH1 Iraq MH1

and progressively deteriorated. The river now adopted its Hindiya channel to an extent of nine-tenths, leaving desolation at Ḥilla, Diwaniya, and Daghara. Government organized repair works, but without adequate funds or energy, and the greater efforts made under M. Cugnin in early 1909 proved unavailing. The Euphrates irrigation position remained menacing or disastrous.

But help was, after all, at hand. The veteran irrigation engineer of Egypt, Sir William Willcocks, had studied the problems of 'Iraq water-control from 1902 onwards, and had submitted proposals to Istanbul through the British Ambassador. Late in 1908 he was appointed Consultant for 'Iraq irrigation, reached Baghdad in December and toured and studied with boundless energy, resolution, and intolerance, while the Mesopotamia Irrigation Survey pursued its work. By 1910 he had solved his problems. From the proposals in his report, most of which still held the field almost intact forty years later, there emerged the necessity for immediate large-scale works. To prevent flooding he demanded regulated flood escapes at key points, with strong embankments and the closing of existing breaches. The Euphrates escape would be at or near Ramadi, into Lake Ḥabbaniya and the Abu Dibis depression. The Tigris escape would be from the Samarrā area through miles of high ground into the Tharthar depression, unless the cost of so vast a scheme proved prohibitive. To raise low-season water-levels and provide reliable supplies to the off-taking canals, a barrage would be erected near Balad above Baghdad, and another at Kut al-Amara to restore the irrigable Gharraf (Ḥai) lands. The ancient Nahrwan canal was, by one of alternative methods, to be restored, and the waters of the Diyalā—and some of the Tigris—to be poured into it. The lower Euphrates swamps would be reclaimed by re-forming the main channels and by providing for flood escape. A barrage at Qarmat 'Ali would give controlled irrigation in Baṣra area. Large-scale drainage would be provided throughout the country by utilizing existing depressions, Tigris navigation would be safeguarded by controlling the great flood channels of the 'Amara district, the Buṭayra, Chahla, Majr Kabir, and Musharra.

Of this programme, grandiose and costly by any standards, criticism was not lacking on the grounds of deficient finances, tribal insecurity, lack of man-power, and chronic Turkish maladministration. But it was boldly adopted by the Turkish Government, with preference for the Hindiya Barrage as the first step. Willcocks witnessed from 1909 to 1911 the failure of further stop-gap attempts to repair the existing barrage, and was soon to experience his first taste of the greatest of all his problems—that of obtaining funds from the Turkish Government. Nevertheless

1: Longrigg G-4, 5 (ca. 1915-1940) MH1 Iraq MH1

312 work on the new Barrage began. Tenders for the complete con-
185 struction were called for in September 1910, and the contract
653 awarded to the British firm of Sir John Jackson & Co.

The construction of the Barrage, then and now one of the greatest works in 'Iraq, was carried out with extraordinary speed by a staff which included Turks, Indians, Armenians, and some 3,500 'Iraqis. The suspicion of certain elements in Turkish officialdom usually turned to gratified encouragement after a personal visit to Hindiya. Labour troubles were few. Transport, especially that on the Euphrates routes from Baṣra, presented extreme difficulties, with tribal blackmail and navigational obstacles: and the continual struggles needed to obtain funds from an empty Treasury in Istanbul and a harassed Daftardar in Baghdad were successful only after actual stoppage of the work seemed inevitable. The iron gates arrived in the late summer of 1913, and a crowded and triumphant ceremonial opening of the whole work was held in November of that year. Although the Barrage, which had cost less than £500,000, still lacked the canalization which it was designed to support downstream, it conferred immediately enormous benefits on the countryside which it served. These would have been a hundredfold greater if they could have included public security, an equitable land system, and some hope of new agricultural methods.

Elsewhere in 'Iraq, much of the earth-work of the Ḥabbaniya Escape in its first phase was completed, and digging of the Ṣaqlawiya Canal was begun but abandoned. Further surveys produced information of great future value, though no other major enterprise belongs to this period. A scheme for watering the Ḥawija, north-west of Kirkuk, from the Lesser Zab was begun without study and ended in fiasco and scandal. More important, and prophetic of a major development of the future, was the growing riverside use of oil engines for irrigation purposes. These increased from a mere dozen in 1900 to some scores in 1914. Meanwhile, flood-bank protection annually renewed followed its unsure and expensive course, rarely effective and always burdensome. The 'bunds' built by Nadhim Pasha for the safeguarding of Baghdad, though they failed partially in their first year, were an important work.

433 These last years of Turkish rule were marked by little industrial development. Some increase in local shipbuilding and the use of irrigation pumps, ice machines, wool and liquorice-presses called for the first time for mechanical repair facilities. The first motor-
494 car appeared in 'Iraq in 1908 from Aleppo; by 1914 less than a dozen were in use. These included a motor-bus service on the Ba'quba road, and the private cars of a few notables. Efforts to mechanize the Kufa tramway had failed.

1s Longrigg G-4, 5 (ca. 1915-1940) MHI Iraq MHI

movements and haunted ministerial ante-rooms now thought of seeking their advantage by Government action rather than by tribal disobedience. Reports made in 1926 show satisfaction at the decrease of raiding, the willing recourse of tribesmen to the Sarays, better Government control, and fruitful use made of the Tribal Disputes Regulations—one of the most valuable legacies of the British régime.

8. DEVELOPMENT

If major irrigation works were precluded in this period by the poverty of the State, it was no less valuable that a permanent irrigation service, staffed by specialists and relying on ever-widening surveys, was watching conditions, accumulating data, constructing small works of immediate value—canal-heads, regulators, realignments—redesigning vital flood-banks, and planning the future. Without it, the stagnation and deterioration of the Turkish era must have continued, and the serious floods of 1923 and 1926, which with disastrous damage inundated outlying quarters of Baghdad itself, including a railway station and Customs warehouse, must have been yet more ruinous. Considerable canals from the mid-Euphrates left-bank above the Barrage—the Ṣaqlawiya and Yusifiya—were re-created and their lands carefully allotted. The Hindiya Barrage itself was extensively repaired and improved. The Department of Irrigation was administered by A. B. Aitken until 1921, by P. J. Sellier until 1925, and J. M. Wilson during that year, and by L. E. Bury from the Sudan from 1925–8.

In the field of agriculture, a department under an 'Iraqi director-general since 1924, J. F. Webster was Inspector-General in succession to the pioneer of Iraq cotton-growing, Roger Thomas; but here, too, far less could be attempted than the needs of the territory demanded. Land settlement could not yet be other than local, ill based, and occasional; the disastrous agrarian background was unchanged; and experiments in new crops, silk-growing, and seed varieties made at the Agricultural Institute must remain at present without effect on the prevailing practices of an agriculturally primeval peasantry. Nevertheless, a beginning was made with scientific cotton cultivation, for which high hopes were formed; the British Cotton Growing Association opened an agency and erected a modern ginnery. A large-scale general farm on mechanized lines was started by an Englishman near Mosul, but did not long survive. The Wolfra Syndicate, which hired land on the Diyalā and attempted modern farming methods, similarly could not overcome native conservatism and renounced its enterprise. The King himself owned an important estate near Khaniqin, and

1: Longrigg G-4, 5 (ca. 1915-1940) MH1 Iraq MH1

312 653 The daily lives of many Iraqis could be affected by progress in agriculture than by even the greatest industry, and such progress in this period was not negligible. The grandiose irrigation schemes for which the press and public called were not, indeed, at once attainable; maintenance, minor improvement, and research were rather the order of the day. Nevertheless, some works of fair magnitude were carried out. New headworks and canalization on the Diwaniya and Daghara branches of the Euphrates were undertaken, and improvements in the water-supply to the Suq rice-lands. Swamp-drainage at Karbalā was primarily a public health measure. A permanent weir across the Diyalā replaced annually renewed antiquated works and secured supplies for the Ruz, Khurasan, and Maḥrut canals. The Laṭifiya Canal, the new Iskandariya, the Shayshubar were dug or re-aligned. A clearance of the Baṣra creeks and a major regulator, opened by the King in 1930, on the Bad'a in Muntafiq country were works of great local value. With them went continuous researches, surveys, experiments in desalination and drainage, and efforts to maintain and improve the 'bunds', breaches of which could ruin a countryside as they did in the disastrous floods of 1926 and 1929, and the necessity for which only the completion of the long-standing flood-diversion schemes could remove. Such was the Ḥabbaniya project, conceived by Willcocks twenty years earlier and closely restudied from 1927 to 1932; in the last of these years tenders were called for and the work seemed imminent. Other major plans, postponed by lack of funds and incomplete data, were the Tigris barrage at Kut al-Amara to restore the Gharraf and to control the 'Amara rice-lands: the smaller Abu Ghurayb canal from the Euphrates left bank, begun in 1932: an 'Aqar Quf drainage project near Baghdad: a proposed reservoir at or near Qizil Rubaṭ to conserve Diyalā water for summer use: a new head for the Ḥilla branch: the Isḥaqi Canal, to take Tigris water from opposite Samarrā: and work on the main Euphrates channel near Shinafiya. The Irrigation Department was administered from 1925 to 1928 by L. E. Bury, who acted also as Adviser to the Ministry of Works and after 1927 to that also of Irrigation and Agriculture. W. Allard succeeded as Director of Irrigation from 1928 to 1933, and as Chief Engineer under an 'Iraqi director in 1933–4. Wheatley resumed the advisership of Communications and Works in 1929, and held it for the next eight years.

241 654 Of the need to improve agricultural methods, if these canal works were to yield all their value, the public was little aware. In spite of continued research and experiment, the main agricultural problems of the territory were yet unsolved—those of soil deterioration, antiquated techniques, inferior crop varieties, low and impure yields, and harvests endangered by flood or drought.

1: Longrigg G-4, 5 (ca. 1915-1940) MH1 Iraq MH1

Their solution must depend on the simultaneous and widespread working of forces of rural education, reliable security, sound land tenure and properly financed enterprise. Meanwhile, the annual locust campaigns in northern 'Iraq were developed jointly with neighbouring countries. Progress was made in hill-country tobacco-growing and treatment of the leaf on modern lines. Silk experiments continued, though with scant success. Cotton-growing was still restricted by unskilled cultivation and by pests. The produce of the great date-groves of southern 'Iraq was bringing difficult problems not only of improved culture but of organization and disposal, and civil war raged between growers and packers. Of the attempts at modern estate development (p. 17) none had yet succeeded. The projected Agricultural Bank could not, it was found, be inaugurated until clearer land-titles gave security for loans. The Aṣfar Concession was limited and revised to provide for the acquisition and development by the Company of the Laṭifiya estate, south of Baghdad; the Irrigation Department constructed the main canal at the Company's expense, and promising operations on the 65,000-acre area began under European management.

The main agricultural development of the time was that of river-side pump irrigation. This had been initiated before 1914 and moderately extended between 1920 and 1925. Aided by important fiscal privileges, it began thereafter to show remarkable increase, to the point of becoming a main feature of 'Iraq's economy. Installations in the liwās of Baghdad, Diwaniya, Kut, 'Amara, and Diyalā had by the end of 1930 brought the number of pumps to over 2,000, representing a million-acre increase of cultivable area. There was evident value in thus attracting capital to agriculture, utilizing the cheap oil available, exploiting the high-lying virgin lands, and avoiding the precarious chances of flood irrigation. But the development was not free from trouble. The attraction of cultivators to new lands rather diverted them from old than increased their numbers; improvement in yields, due to fresh lands and secure irrigation, was not matched by superior type or purity of crops. Estate management attempted by townsmen was sometimes short-sighted and uneconomic, and the hard times and low prices of 1930–1 brought ruin to many hopeful enterprises. These, moreover, jointly undertaken by an urban capitalist—often a Deputy or city notable—and a tribal shaykh or *sirkal*, were productive of puzzling difficulties of land tenure and rights. Neither the traditional occupancy of the tribe, nor the share claimed by the incoming capitalist, had any basis in law. Agreements between the parties often proved unworkable, and in practice did not always bring blessings to the cultivators. These conditions indicated, yet

1: Longrigg G-4, 5 (ca. 1915-1940) MH1 Iraq MH1

241 473 types, and low yield depressing to the ambitious farmer. The Başra date industry, in which British and American packers and exporters had a dominant share, made its divisions yet more explicit in 1933 by the appearance of rival organizations within it: the Government-approved Date Growers Association on the one side, and an association of date packers on the other. The clash of interest and tactics between these two, both fully representative of their respective interests, resulted in disastrous conditions in the industry and led in 1935, after a visit to Başra by Yasin Pasha, to the passage of a law establishing a Date Board with representatives of all Başra date interests and its own direction and revenues derived from a small export tax; it effected for a time a marked improvement in growing, packing, and exporting conditions. A Committee was set up in 1933 to investigate beet-sugar production, and found reason for hopefulness. The first suggestions were heard of a monopoly for the manufacture and marketing of tobacco products, and meanwhile something was done to improve the drying, cutting, and packing of the Kurdish leaf. 'Iraqi cotton, the object of high hopes ten years before, passed through a depressed period. The crop climbed slowly to 5,000 bales by 1928, only to drop almost to nothing and to recover to 3,000 bales in 1934. Thereafter substantial yearly increases appeared, and by 1938 15,000 bales were produced. Among the cotton-growers was the Latifiya Company (p. 213), an enterprise which, however, found itself early in its career in serious difficulties. It failed in its undertaking to repay the cost of its canal to Government, and in 1935 control was assumed by Messrs. Andrew Weir & Co.; thereafter, with fresh finance and a revision of its agreement with Government, the progressive agricultural work of the estate could proceed. It was to remain under single and personal British management for the next twenty years. The Agricultural and Industrial Bank was unable, in its early years, to do much for the public.

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241 312 Pump irrigation, which the economic crisis of 1929–31 and the prevailing low prices involved in widespread losses and stoppages, recovered gradually after 1933 and stabilized itself as a main feature of 'Iraqi production. It had introduced, for better or worse, a new element into local agriculture—the urban capitalist; and it helped thus to lead part of the wealthier class to a fresh interest in rural affairs and modern forms of land development. In flow irrigation the period—the first in which surplus State funds became modestly available, thanks to oil royalties—was one of progress. The first stage of the forty-mile Abu Ghurayb canal, from the Euphrates left bank below Ramadi, was completed in 1936 with a considerable commanded acreage. The Mishkhab regulator, low down on the Kufa channel of the Euphrates, was built in 1936. A canal deriving

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from the Lesser Zab west of Altun Kupri and irrigating land in the Ḥawija was begun in the same year. Schemes for a Diyalā dam, and for a restoration of the ancient Isḥaqi canal were studied, but the long-favoured Ḥabbaniya scheme seemed unable to come to life. It was re-formulated in 1932; tenders were invited next year but none accepted; and in 1934 the project seemed likely to be reduced to the scale of a mere flood reservoir, whereafter, for a time, no progress in the scheme was made. Its place as first favourite was taken by the Tigris barrage, to control the Gharraf river from its point of bifurcation opposite Kut. This project, which allowed by means of locks for continued Tigris navigation and for fish movement, was put to tender in 1934. Work was begun by the chosen contractors, Messrs. Balfour Beatty & Co., and by mid-1937 it approached completion—the second of the great Willcocks schemes to be realized; but the dependent canalization necessary to ensure its full value would require much further time and effort. The collapse in 1935 of the Diyalā weir, built in 1928, was a setback which called for large-scale restoration, and steps to this end were taken in 1936–7. The upkeep and improvement of existing canals continued with increasing use of ʿIraqi technical personnel, and with it further study of the abiding problems of flood protection, drainage, water economy, and silting. There was little money to spend.

6. FOREIGN AFFAIRS

Both events within ʿIraq and the external contacts natural to a modern State led during these years[1] to greatly widened relations between Baghdad and the world outside. The process of establishing these was continuous; prestige and strategy both played their part; and no sphere of Government activity was freer from party politics. The system continued whereunder ʿIraqi representation abroad was entrusted to the diplomats and consuls of Great Britain, save only at Geneva and at the small but increasing number of capitals to which ʿIraqi Ministers were appointed. The Soviet Union alone refused to accept this system, or to recognize ʿIraq.

Italy, to which a State visit of King Fayṣal had been planned before his death, courted ʿIraqi goodwill. In spite of Sanctions, in which ʿIraq conformed to the British attitude towards the aggression against Ethiopia in 1935, Italy secured ʿIraqi armament orders in 1936 and later fêted and decorated ʿIraqi visitors to Rome (where a Legation had been opened in 1934) and subsidized in Baghdad a newspaper Fascist in tone, the *Shaʿab*. On the whole, however, Italian activity was less evident in ʿIraq than in the Levant States, and foreshadowed the assignment of that territory, with Persia, to

1 - [Mid-nineteen-thirties -- Analyst]

1: Longrigg G-4, 5 (ca. 1915-1940) MH1 Iraq MH1

to ensure Arab rights in the Holy Land, or by that of the Foreign Minister 'Ali Jawdat to Sa'udi Arabia in June.

The child-King was taken to the Lebanon for the summer, and there hailed by village enthusiasts by the roadside as 'King of Syria'. In Baghdad a new British Ambassador, Sir Basil Newton, to whom the Middle East and its problems were unfamiliar, succeeded Peterson in March 1939.

The financial needs of the State, which thanks to over-spending were now serious, were met by a grant of credits by the British Government for the pressing needs of the Railway, and equipment for the Army. Nearly £4 million was thus made available on the security of 'Iraq's oil revenues and with conditions of moderate interest and repayment spaced over seventeen years. An interest-free loan was granted at the same time by the 'Iraq Petroleum Company in return for a seven-year postponement of its export obligation under the B.O.D. Company's concession; it was payable in six half-yearly instalments of £500,000 each, and repayable at leisure out of royalties.

The Railway section from Tall Kochek to Mosul was completed, at unexpectedly high cost, and trains could now run from that city to Istanbul. The Kut barrage and Gharraf headworks were completed in March 1939: the official opening had been King Ghazi's last public act. With its fifty-six mechanically-operated gates, overall width of 1,615 feet, lock, and fish-ladder, this important work had cost £1,200,000 and, given full dependent canalization (at present lacking), was capable of the controlled irrigation of a million acres. The seven-gate Yau regulator, at the end of that branch of the Kufa channel, was erected in 1939–40, also by Messrs. Balfour Beatty. A new and improved Diyalā weir (p. 263) was undertaken in 1939 and completed by the end of 1940. Execution of the Ḥabbaniya project, which had been revived urgently after the Euphrates floods of 1938, was entrusted in June 1939 by contract to Messrs. Balfour Beatty for £700,000 for the first phase, that of the intake canal to the lake at Ramadi and the controlled outlet from the lake to the vast Abu Dibis depression. Work on these was pressed forward. The first of the two steel bridges at Baghdad, built under contract by Messrs. Holloway Bros., was completed; it formed an imposing structure, 700 ft. long and 50 ft. wide, and, named al-Ma'mun Bridge, was opened with ceremony by the Regent. Bridge tolls were abolished throughout the country. A long-standing project drew nearer to realization when a Government bank, to be known as the Rafidain Bank, was established by law though not yet opened; its initial capital was fixed at £500,000, subscribed in part by the State. A revised version of the capital works programme was evolved by Rustum

1: Longrigg G-4, 5 (ca. 1915-1940) MH1 Iraq MH1

even the basic validity—of the oil concessions was a usual move of politicians in opposition.

In the greatest of 'Iraq's industries, that of agriculture, the war was a period of unusual activity, stimulated by the need to produce and by high prices. Agricultural machinery, thanks to lend-lease supplies, was seen almost for the first time in the northern liwās and those of Baghdad and Kut; in 1945 some scores of tractors, mechanical ploughs, cultivators, and combines were in operation, with great effect on 'Iraqi conceptions of agricultural possibilities. Projects for ambitious modern farming took shape among the educated and the owners of capital; a College of Agriculture had been founded in 1941; and a law was passed in 1944 authorizing the establishment of agricultural Co-operative Societies. But none of these measures prevented the increasing drift of countrymen in their hundreds or thousands towards the towns, where war-time employment was plentiful. In the field of land settlement, the committees, which had worked steadily and in increased numbers since 1933, were wisely kept at their all-important tasks throughout the war. Only minor attention was given as yet to southern 'Iraq, and little to Mosul, Arbil, Dulaym, Diwaniya, or Karbalā liwās; but much was done in the dispute-ridden agricultural lands of Kirkuk, Baghdad, Ḥilla, and Diyalā, where good progress was made with definition of land categories, the mapping of boundaries, and the recording of individual registrations over areas which now approached a million acres. Much was heard of plans both for model villages and for the allotment of small-holdings of Government land to single families—a sign that the evils of peasant insecurity, poverty, and lack of incentive were now fully realized. On the Dujayla Canal, dependent on the Kut barrage, work under a special law started in 1945 on a practical settlement of families on sixty-acre State-owned plots, with the incentive of free title to be gained after ten years of work; and meanwhile village institutions and amenities—school, farm offices, nurseries, dispensaries, and a co-operative store—were provided by the Directorate. The Dujayla Scheme was full of promise; it started with eighty carefully-chosen families, later to be multiplied tenfold, and it aroused keen competition for admission.

'Iraq's security after 1941 allowed its vital Irrigation services to continue their canal maintenance and flood protection, their studies and planning, though the intended major projects could not at present be initiated. The work interrupted in 1941 on the Ḥabbaniya–Abu Dibis outlet was completed by 1943, and the intake-channel from the river (begun under Willcocks) and the return-channel to it, were redesigned but not yet undertaken. Pump irrigation was fully maintained.

1: Longrigg G-4, 5 (ca. 1915-1940) MH1 Iraq MH1

Palestine—was common from 1932 until the mid-war period. It was probable that, with research and the establishment of a responsible authority not hitherto created, present production could be largely increased. Fishery development had in 1948 found its way into ministerial programmes; a trawler for use in the Shaṭṭ al-'Arab approaches was delivered in 1950, and a fish store was projected by the Agricultural Bank.

The history of 'Iraq's irrigation from 1946 to 1950 is one of rapid approach to, or even the partial realization of, prospects long desired and, through new-found wealth, by 1951 fully practicable. The call for heroic measures was the clearer since the disastrous floods of 1946 and 1948 and the acute grain shortage—in a territory of fabulous potential output!—in the latter year; and in 1946 the resources of the highly competent Irrigation Department were supplemented *ad hoc* by the appointment of a well-staffed Irrigation Commission under F. F. Haigh of the Indian Service of Engineers. Its object was to study and report on river control and irrigation, and to submit a programme. The Commission reported in June 1949.

The task of flood control and storage was to be carried out on the Euphrates by a completed and extended Ḥabbaniya–Abu Dibis project: on the Tigris, by the grandiose Wadi Tharthar project (in two stages), by the 'Gibraltar' dam on the Diyalā at its point of passage through the Jabal Ḥamrin, and by the Dukan dam on the Lesser Zab. These works, all pronounced practicable, would save 'Iraq from floods and would greatly increase its low-season resources. They would be accompanied by the development of irrigation in new areas by canals, headworks, barrages, and feeders on the middle Euphrates, the lesser Zab, the middle Tigris (in the areas commanded by the Ishaqi and Nahrwan canals), on the Diyalā river, and on the Gharraf and lower Tigris. Drainage was to be taken comprehensively in hand in both existing and projected irrigated areas, on lines which experiments made from 1940 to 1946 had shown to be practicable. Hydro-electric power was to be developed at the Samarrā headworks, the Wadi Tharthar outlet channel, and the Gibraltar and Dukan dams. Plans for the reclamation of the southern 'Iraqi swamps, and the re-formation of the lower Tigris, were suggested but not formulated. Of this gigantic programme, expected to cost some ID 90 million, about a quarter of the whole was to be undertaken immediately and finished within ten years: it would include the first part of the extended Ḥabbaniya and of the Wadi Tharthar schemes, the Gibraltar dam, drainage work, and the extension of existing irrigation in the Nahrwan and Gharraf areas and on the Euphrates. A large part of these plans was adopted by the Development

1: Longrigg G-4, 5 (ca. 1915-1940) MH1 Iraq MH1

Board[1] at its early meetings in 1951 and they were, with possible modifications, to form the basis of 'Iraq's future irrigation activity, whose full realization, however, must, for all the impatience of the public and the press, occupy not less than fifty years.

Works actually completed before the end of 1951 were the realigned Habbaniya inlet (Warrar channel) and the return outlet to the river (Sinn al-Dhibban channel), ensuring flood protection and making possible the use of stored flood water. The Wadi Tharthar inlet channel—a work of very great magnitude—was put to tender by the Development Board in 1951; the Samarrā barrage and headworks, and the greater Habbaniya scheme, were to follow later. Much detailed planning and designing remained to be done, even for the immediately following five years, before a programme, especially in lower 'Iraq—'Amara, Baṣra, and the Gharraf—could be established. The extent, however, to which the Willcocks plans of forty years earlier had stood all tests was indeed remarkable. Only the Faluja and Balad barrages (p. 63) had been abandoned, and development in the Baṣra–Hammar area might or might not in the end follow Willcocks's plans. The abiding problem of silt deposit appeared partly soluble, by improved headwork design and by mechanical clearance. Pump irrigation seemed by now to have reached its economic limit in much of the territory, but there was ample room for more intensive cultivation of the pump-lands.

The connexion of reasonable and stable forms of land tenure had long been recognized by Government in its land-settlement activity, and the latter had a creditable volume of achievement to show after eighteen years of sustained effort. Early criticism of the procedures adopted (p. 261) and the progress of the work itself throughout 'Iraq (p. 323) have been elsewhere described. Five more years' work since the end of the war had defined, delimited, and recorded the personal rights in other wide areas. The abiding problem of Muntafiq land rights had not yet been solved; in 'Amara an answer not very different from the *status quo*, but with longer-term security for the shaykhs and greater fragmentation was likely to be found. Elsewhere the hard case of the landless fallaḥ was little changed wherever he had been unable to establish a basis of title and, at the opposite extreme, the good fortune of

[1] The Board's six-year plan, legalized early in 1952, provided for year-by-year expenditure, from 1951–6 inclusive, on the Tharthar project, to a total of (in thousands of ID) 16,300: on the Habbaniya, 2,200: on the Diyalā dams and canalization, 6,750: on the Dukan dam, Ḥawija barrage, 'Udhaym barrage and canalization, 6,750: on the Bakhma dam, 8,700: on irrigation works in Mosul and Arbil liwās, 1,900: Tigris barrage and canalization, south of 'Udhaym mouth, 1,800: and main drainage, 4,100. New and re-formed canalization on the middle and lower Euphrates, lower Tigris and Gharraf, and Baṣra area were allotted 10,425.

2: Dowson G-5 (1929-30) 1932 MHI Iraq MHI

About four-fifths of the country consists of unproductive or slightly productive desert, steppe, marsh and hill masses. The productive core is divided broadly into two regions within which cultivation is practised regularly. The northern region is fed by rainfall supplemented by perennial streams rising in the mountains and, to a limited extent, by lift from the rivers. The southern region largely depends upon irrigation, supplied by canals drawn from the river system, following winter rainfall. The former may be appropriately called the Rainfall Zone, and the latter the Irrigation Zone. Actually the southward extension of the northern rainfall varies annually, while the date gardens of the Basra Liwa constitute a distinct (and of course economically a very important) study. But this does not affect the correctness of the broad picture presented.

Reference to Table I will show that the region of cultivated and cultivable land within the Rainfall Zone covers about 41,000 square

TABLE I. APPROXIMATE CLASSIFICATION OF LAND SURFACE, 1930

Expressed in square kilometres

Liwa	Total area all land	Hill mass	Cultivated Region				Additional potentially cultivable territory	Total cultivated and cultivable region	Territory containing large holdings	Size of holdings in nisbans*			
			Rainfall Zone		Irrigation Zone								
			†3% hill mass	Plains	Canal fed territory†	Machine fed land territory†				1-100	101 to 500	501 to 1,000	Over 1,001
Mosul	45,800	9,380	190	14,560	—	—	270	15,040	7,870	—	—	—	—
Arbil	16,600	7,630	180	7,010	—	—	—	7,160	2,430	7,418	728	300	—
Sulimani	9,300	6,400	130	2,430	—	—	—	2,550	2,280	—	—	—	—
Kirkuk	20,800	—	—	12,020	—	—	3,240	15,260	6,280	—	—	—	—
Diyala	16,200	—	—	710	2,760	90	260	3,820	3,410	4,092	—	546	—
Baghdad	22,100	—	—	—	1,710	2,270	890	4,870	1,500	162	220	120	360
Dulaim	124,500	—	—	—	920	630	20	1,570	920	2,344	109	121	3
Karbala	21,200	—	—	—	660	—	20	680	620	—	—	—	—
Hilla	8,100	—	—	—	4,570	330	1,630	6,530	2,380	452	364	98	82
Kut	16,400	—	—	—	4,680	3,860	2,170	10,710	2,580	—	—	—	—
Diwaniya	83,000	—	—	—	3,770	2,180	5,320	11,470	2,270	8,378	—	155	69
Muntafiq	38,700	—	—	—	4,440	270	370	5,080	6,280	—	—	—	—
Amara	19,700	—	—	—	5,670	1,010	—	6,680	110	—	10	5	50
Basra	10,900	—	—	—	610‡	60	110	780	1,190	—	—	—	—
Totals	453,500	23,370	470	36,740	29,780	10,700	14,500	92,200	40,060	—	—	—	—

*Where information was available. Such information must not be presumed to be exhaustive. A nisbara = 2,500 sq. metres or thereabouts.

†Territories so classified are at present very incompletely irrigated. ‡Tidally watered date gardens.

kilometres, and that within the Irrigation Zone about 51,000 square kilometres. These figures represent 9 per cent. and 11 per cent. of the total land surface of the country respectively. The cultivation is preponderantly of an extensive character. Only a fraction of these zones, possibly from a fifth to a tenth, appears to be actually cultivated in any given year. So that land is available for a very great development of agriculture, when other factors are favourable.

The information given in the table regarding the size of holdings is derived from fiscal returns. Although the classification of these holdings by area cannot be expected to be accurate, the figures possibly give some indication of the frequency of larger and smaller holdings in the districts actually concerned. The latter must not be taken to coincide with the cultivated areas of the liwas themselves.

3. Agricultural Population

3. In any general study of the land tenure of a country it is desirable to know the numbers and distribution of the agricultural population. Thus it would greatly assist in planning development in el 'Iraq if trust-

Government Department, certainly beyond the power of the organisation and resources so far devoted to the purpose. 423 427

This is not to say that no systematic efforts have been made to put the tenure of miri land on to a more secure and orderly basis. Many such efforts have been made throughout the country by Provincial Officers, the Irrigation Department, the Survey and others. Foremost among them must be mentioned the periodic revenue settlements in Amara, which not only defined the limits of the various tribal interests there, but have also tended to stabilise many lesser holdings. A valuable fiscal survey of a large part of the Basra Date Gardens has been done. A business-like survey, allotment and record of land accompanied the construction of the Yusefiya, and other canals: and pains have been taken to keep these records up to date. In the Dulaim liwa a careful list of all the holders of recognised parcels of land has been compiled and subsequent changes noted. Other instances could be given. Naturally, all the resulting compilations have serious imperfections regarded as permanent records of the rights admitted to miri land: but this was not usually their primary purpose and such imperfections were inevitable in the conditions under which the investigations had to be made. And whatever the imperfections of such undertakings may be, they deserve grateful recognition and they should materially facilitate further stabilisation of tenure. 427 185

But it must none the less be admitted that these were all detached uncorrelated efforts owing no inspiration to any concerted attempt of the Central Government to improve the position of the mass of holders of miri land. Broadly speaking, those who occupy and cultivate miri land are allowed to do so in the absence of more influential opposition. Possession is ordinarily nine points of the law: but neither long possession nor any other mode of acquisition confers security. Personal influence with the most effective arbiter is commonly the decisive factor at any moment in any particular land dispute: and anyone may find the most convincing claims set aside. Moreover, any dispute may be reopened at any time if circumstances promise a more favourable consideration of a disappointed party's case.

Having regard to the history of the land, the widespread acceptance of tribal rather than individual rights, and the extensive and ill-defined areas affected, this state of affairs is not really remarkable: but it none the less calls for recognition and progressive remedy.

3-7. Pump Development of the Riverain Tracts

3. As is well known there has been a rapid and extensive development of irrigation by privately owned pumps during the last ten years throughout the high level tracts bordering the main waterways (see Plates I and II). As is also well known, the confident expectations of an early and profitable return on the considerable sums sunk in this development have been largely disappointed. 312

Persevering efforts have been made to obtain consistent and comprehensive statistics of the numbers of pumps erected, of the horse power of those pumps and of the areas irrigable by them: but owing to the records having been differently dealt with at different times and in the various liwas and departments concerned, it has not been found possible to do so. Although this is disappointing, in view of the interest and importance of this development, it is not surprising. And I have none the less been enabled to illustrate the rapidity and extent of the

312 movement in Table VI clearly, if not as completely and as accurately as I hoped to do. Although the figures given are incomplete and inexact in places they can be relied upon in the aggregate to furnish a trustworthy general picture of events. It will be seen that whereas in 1921 there were probably something like 140 pumps averaging about 11 horse power installed almost exclusively in the Baghdad and Amara Liwas, in 1929 there were over 2,000 pumps averaging from 25-30 horse power extending along all the principal waterways of the country. On the estimated basis of 50 *misharas* * per horse power the area irrigable by the former was about 200, by the latter about 7,400 square kilometres. According to Table I the total area of the riverain tracts affected is over 10,000 square kilometres; but only a fraction of this can be annually cultivated. The data are crude and the results must be regarded merely as rough approximations: but they indicate the wonderful extension of private pump irrigation that has taken place during the last ten years. It is [431] also interesting to note that the importation of pumps for irrigation purposes during the ten years 1920 to 1929 were 28, 110, 42, 13, 157, 157, 238, 288, 468 and 570 respectively, or a total of 2,066.

It is my duty in this report to consider this development primarily from the point of view of land tenure and in that connection to make some criticisms about the methods of land acquisition adopted that appear obvious enough now. Seriously as I think these errors have jeopardised the success of many of the pump undertakings, this should not be allowed to obscure the beneficial character of the general effort made, the valuable safeguard against famine that it provided, and the [166] powerful incentive to settle on the land that it created. And if the movement had not unfortunately coincided with the severest economic depression that the civilised world has encountered, the effects of the initial mistakes made would have been less prompt and less serious.

241 464 465 439 6. The general failure of a development from which so much was hoped, is ascribed jointly and severally to a number of causes. Among these may be mentioned (*a*) the absence of a suitable paying summer crop, (*b*) the shortage and indisciplined character of available labour, (*c*) the prevalence of the share system of payment for labour and the consequent dislike felt by agricultural workers for crops that cannot be shared on the field in kind, (*d*) the lack of competent and dependable local agents and mechanics, (*e*) the poor and dirty quality of much of the produce and the consequently poor reputation of Iraqi agricultural commodities in the world's markets, (*f*) the defects of internal and the costs of external transport, (*g*) the general economic depression of the world and the glut of the world's markets with grain.

185 The question is such an important one, not only from the point of view of those who have sunk money and effort in these enterprises but also owing to its effect upon the prosperity and well-being of the whole country, that the Government for a long time have sought remedies in special legislative proposals designed to remove some of the difficulties mentioned. Among the objects more particularly aimed at may be instanced: the enforcement of the cultivation of a certain proportion of money crops (e.g. cotton), the binding of labour more closely to the soil, and the better regulation and more effective use of such labour. The power of legislation to bring about these and other improvements in the economic conditions of this extensive agricultural development, appears to me to be over-rated and the dangers of restrictive legislation operating adversely to be insufficiently realised.

312 Most of the causes enumerated earlier have probably exerted a

* A mishara is reckoned = 2,000 sq. metres.

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TABLE VI. PUMP DEVELOPMENT OF THE RIVERAIN TRACTS, 1921-9

NUMBERS AND AGGREGATE HORSE-POWER OF PUMPS EXISTING

Liwa	1921 No.	1921 H.P.	1922 No.	1922 H.P.	1923 No.	1923 H.P.	1924 No.	1924 H.P.	1925 No.	1925 H.P.	1926 No.	1926 H.P.	1927 No.	1927 H.P.	1928 No.	1928 H.P.	1929 No.	1929 H.P.
Mosul	(1)		(1)		(1)		(1)		(2)		(4)		(6)		9*		13*	
Kirkuk									(1)		(2)		(3)		4*		5*	
Diyala			3	41	4	48	8	102	17	336	32	683	37	1,009	54	1,427	55	1,445
Baghdad	103		111		102		107		195		(380)		(490)		856*		1,025*	
Dulaim	1		2	25	2	25	4	69	6	119	9	200	16	371	41	1,060	90	2,833
Karbala	1		1		1		1		1		1		1		2		3	
Hilla	(1)		(2)		(3)		(4)		(6)		(12)		(18)		24*		34*	
Kut			2	15	6	51	14	136	27	364	32	140	73	1,512	165	3,508	390	10,904
Diwaniya	6	53	12	160	16	239	34	669	97	2,206	143	3,434	177	4,605	216	6,044	243	7,165
Muntafiq									4	46	4	46	15	406	20	635	34	1,268
Amara	30	337	35	403	44	504	48	557	51	609	54	664	56	741	90	2,113	139	4,256
Total number of pumps	143		169		179		221		407		673		892		1,481		2,031	
Average horse-power returned‡		10·8		11·9		12·0		14·2		18·4		18·8		23·0		25·2		29·1
Approx. total area served in square kilometres†	190		250		270		390		940		1,580		2,560		4,670		7,380	

* Figures supplied by the Irrigation Department. All other figures supplied by Liwas.
Figures in brackets are guesses founded on such information as was available.
When not given, the horse-power figures were not returned or are too doubtful to use.
† The approximate areas served are based on an allowance of 50 mishoras (0·125 sq. km.) per horse-power.

‡ The Irrigation records indicate that the average horse-power of all the pumps installed is somewhat lower than that of those returned here, e.g. 24 in 1923 and 26·8 in 1929. This would reduce the areas served in those years to 4,450 and 5,450 sq. km., on the basis given. The Department's 1930 figures show an increase in average horse-power to 28·1, a reduction of about 100 pump installations in the Baghdad liwa and of about 20 in the whole country. The principal increases are in the Amara and Kut liwas.

312 seriously, many a decisively, injurious effect on the success of pump development as a whole. These difficulties all call for careful study and for steady and carefully considered ameliorative measures. They are, however, for the most part outside of the scope of this report. But underlying and aggravating all other difficulties there is a widely prevailing uncertainty of rights to hold and to exploit the land affected. This has in many cases poisoned the relations between the two classes mainly interested in the majority of these enterprises and reduced to a minimum the prospects of their successful co-operation. And it has nearly always left the rights and the obligations of those concerned injuriously indefinite towards both the Government and to those associated with them. Consequently the bulk of these pump-fed areas have never received the single-minded and unified agricultural management that was, and is, an essential condition of success. It is possible, perhaps likely, that the other adverse conditions recited would in any case have prevented the general and widespread success anticipated. But a number of instances have been given me of pump ventures that have proved profitable in spite of these handicaps, because unified management was, for one reason or another, possible and realised.

427 Be this as it may, it is indisputable that the prospects of general success would have been increased if in all cases the rights to the land
311 affected had been authoritatively settled and the requisite unification of agricultural control had been secured, before capital and energy had been so lavishly expended on these ventures. It was most unfortunate that this remarkable agricultural development should have coincided with the singularly unstable economic period that has followed the war. But it can also be recognised now, in the light of experience, that the rush to develop these riverain tracts was carried out without sufficient preparation and foresight, and at a rate and to an extent which made too drastic demands upon the adaptability and the numbers of the primitive agricultural population upon whose efforts success ultimately depended.

311 The riverain tracts, which are primarily affected, are among the
312 most valuable agricultural areas in the country, because (*a*) of their contiguity to the main waterways and roadways, (*b*) of the natural fertility of the alluvium deposited along the river ridges which contain them, and (*c*) of their relatively high levels, which facilitate drainage and minimise the dangers of high floods. But owing to the last quality any regular cultivation of these tracts necessitates the installation of some artificial means of lifting the water from the adjacent waterway on to the land.

312 Prior to the recent pump development such artificial means of water lifting were virtually confined to the local water wheel (kerid) or to other simple devices, operated by animal or man power. Where kerid cultivation exists to-day it seems not infrequently to be more efficient than pump cultivation, since the more laboriously acquired water tends to be more carefully used and the land to be more carefully tilled to receive it. So it may be accepted that where cultivation by kerid or other simple lifting devices existed previously, such cultivation was usually good of its kind.

311 It therefore appears that until recent years cultivation in these valuable tracts was restricted to certain fringes watered by the simple types of lift mentioned, supplemented by rain in good years, and by flood water, through flood channels, when and where conditions permitted. And since land was comparatively plentiful and cultivators
[464] comparatively scarce, the parcels of land actually cultivated varied incessantly to meet soil impoverishment, flood devastations, river

changes, canal silting, tribal movements, Central Government action, or other circumstances. 311

7. With relatively little exception the riverain tracts affected are miri land. It has been noted how the cultivation previously shifted therein in response to changing circumstances. The prescriptive claims to pasture were naturally even more variable and indeterminate. It is consequently not surprising that as the pump development movement extended, these riverain tracts were found so closely interpenetrated by prescriptive claims (lazma) of one sort or another, that few areas suitable for pump development were unaffected. These claims constituted a serious obstacle to the general development of the riverain tracts by pump installations. For at first the claimants as a whole had neither the desire, nor the enterprise, nor the ability to raise the capital needed to undertake this development themselves. 311 423 427 312

In discussing these prescriptive claims earlier their primarily tribal origin was mentioned: and it appears that the prescriptive rights recognised by the provincial authorities in pump agreements are preponderantly of such origin and character. These pump agreements may be made in the name of a sheikh or sirkal, but he stands as the tribal or sub-tribal, representative. No doubt when the sheikh or sirkal is a forcible person, he may engulf in his own person the rights of his tribal associates. Alternatively when the sheikh or sirkal is a man of straw, unable to lead his section or keep it together, he may be displaced, and even lose his strictly tribal share in the common holding. In a number of cases, after the movement started and its potentialities had become more apparent, a sheikh or other leading member of a tribal section which claimed prescriptive rights over a promising area, himself erected a pump and cultivated the area with the labour of the other members of the section. Under these circumstances the difficulties of divided interests and divided control, so frequently attending these pump ventures, may not arise. And so far as my information goes it is pump ventures inaugurated and worked by a capable tribal leader under these conditions that promise to be the most successful. 427 312 622

But enterprising townsmen and others with tribal affiliations, who wished to participate in the movement usually had to search for a suitable stretch of miri land and enter into an agreement with some group of claimants to prescriptive rights over it. No very definite procedure was required. The process may be loosely generalised somewhat as follows. An enterprising individual, having some miri land of uncertain limits and subject to uncertain prescriptive claims in mind, decided to buy a pump and engine, the capacity of which usually depended as much on his financial resources as the situation and extent of the land to be watered. He applied to the Governor of the Province for permission to erect the installation. This always necessitated a permit from the Irrigation Department (under the Irrigation and Embankments Law), and when the land was miri (as it usually was) the approval of the State Domains Department and the issue of a lease by them. 427 312 311

The Irrigation Department checked the suitability of the installation to the extent of land, according to the information given; and if they had the means tried to locate the land and check the area on a map. Otherwise the figures had to be accepted as notified. And even when the capacity of the installation and the area of the land (as quoted) were discrepant, it was often found that the pump had already been bought. The Department also tried to ensure that the site of the pumping plant was wisely chosen in regard to flood and low stage river conditions, as well as the distribution of the water for cultivation.

The State Domains Department acted through the provincial authorities, who necessarily had no better information as to the situation

427 311 312

and extent of the land affected than could be furnished to, or provided by, the Irrigation Department.

But probably the two most unsatisfactory features of the proceedings were (i) the failure to settle the rights of prescriptive claimants definitely before allowing agreements to be made with them as *de facto* landholders, and (ii) the loose and unsatisfactory agreements, commonly entered into, between these claimants and the pump owners.

It is apparent now that it would have saved time, money and a great deal of trouble in the long run to have investigated and settled all prescriptive claims at the outset. It was reasonable and equitable that prescriptive claims based on effective exploitation of the soil should be recognised. But such recognition should have been coupled with an equally definite limitation of the claimants' rights to these specifically recognised areas. It was clearly unreasonable and contrary to the public interest that, in addition to such properly recognisable rights, a vague mass of indefinite and shifting claims should be allowed to persist and to interfere with the economic development of these tracts as a whole. It was desirable when the opportunity occurred to define alike the rights of prescriptive holders and the balance of unincumbered miri land free for exploitation by other parties under lease or grant from the State. And since the object of pump development was a much greater extension of cultivation it was evident that the necessarily restricted limits of previously existing cultivation would tend to be obliterated thereby. Consequently, if prescriptive claims were to be recognised on the only clear and equitable basis possible—that of effective exploitation of the land—it was important to investigate and record the existing limits of such exploitation before these limits were effaced.

If this had been more evident at the time, such claimants could no doubt have been justly accorded considerably smaller areas than are now claimed, while the Government would have secured a balance of free miri land irrigable by pump which might have been leased directly to those desirous of erecting pumps. No doubt in these circumstances the areas available for lease to pump owners would often have been awkwardly interspersed with the recognised prescriptive holdings; but this was unavoidable unless such claims had been repudiated. And if both parties had known exactly where they were at the outset, agreements between them could have been entered into on a much more satisfactory basis than was as a rule actually possible.

As it is the peculiar difficulties that have arisen in the tenure of these riverain holdings have been primarily occasioned by the uncertainty of the respective rights of pump owner and prescriptive holder, when these are different parties. When they are united in one person, or in a tribal or other group that displays effective cohesion, current difficulties for the most part resolve into those commonly attaching to the holding of miri land elsewhere. It is true that certain obligations are due to the situation of these holdings in proximity to the main waterways (e.g. the maintenance of flood protection) but these can be separately considered and were neither new nor unexpected.

So the problem of the riverain holdings in which pump development has taken place may be regarded essentially as a particular case of the general problem of the tenure of miri land. But this merely makes at least a provisional solution of this larger question the more imperative. And any such solution, when applied to the pump areas, must also provide for the definition and reconciliation of the respective rights of pump owners and prescriptive holders, when separate parties in a joint undertaking.

185 pushed forward in conjunction with settlement operations without delaying the latter. Broadly speaking this means that settlement can be carried out as extensively as men and resources permit in the Irrigation Zone, but must be limited in the Rainfall Zone to the immediate vicinity of Mosul town (see Plates III and IV).

423 185 In this neighbourhood the land is widely held, or claimed, in tapu tenure (see Plate II) and special efforts have been made by the Tapu Department during recent years to clear up uncertainties and define the parcels justly affected. It was primarily on this account that a considerable block of isolated detailed survey has been completed here. Settlement of this block of territory therefore appears preponderantly to involve an investigation and definition of the parcels held in tapu tenure and, so far as such parcels are concerned, to have been in progress for some time. But rights to tapu tenure should be systematically reviewed and if possible rights to miri land concurrently settled, throughout this area by an independent Settlement Officer in collaboration with the Survey at an early date.

In the Irrigation Zone a considerable amount of detailed survey has been completed in every liwa and there is a wide range of territory in various stages of readiness for systematic settlement.

423 185 651 In el Amara, as is well known, the political and administrative conditions have been retained on an almost exclusively tribal basis, the miri lands (of which the liwa is almost exclusively composed) being farmed out to various tribal sheikhs for triennially assessed payments. It is impossible to discuss the details of these methods here; nor is there any need, since the agrarian conditions of no liwa have been investigated and reported on so regularly or so fully, owing to these periodic assessments. Each successive assessment has built on that which preceded it, but has been carried out in greater detail with increasing attention to the smaller men who hold from the leading sheikhs and really manage and work the land. If public security and genuine national consciousness continue to grow these periodic assessments should crystallise steadily into an effective settlement of rights to land. But the conditions under which the work had to be done in the past were extremely difficult, and if this end is to be obtained (and even if the revenue assessments are to be as equitable and reliable as is now reasonable and practicable) the work must be more closely based upon trustworthy detailed survey and rights be investigated more thoroughly than has so far been possible. A reassessment of the Amara estates (muqata'as) was due, and has doubtless been undertaken, this year. And under the agreements in force with the leading sheikhs the prevailing system terminates and is open to review in 1984. The consideration of fuller and more permanent settlement of rights in this district can therefore properly be left over until this termination approaches, or a further reassessment is arranged.

In the Basra liwa, as already observed, an excellent fiscal survey of the date gardens was carried out several years ago. And the principle of a regular Land Tax has long been familiar through the operation of Midhat Pasha's enlightened *jarib* tax.* The tenure of these gardens (mulk or miri) appears to be rarely, if at all, disputed. For the most part the mulk owners are well known, or could readily be determined. 185 Consequently a relatively minor effort would enable titles to be authoritatively reviewed and, when necessary, settled throughout the Basra reach on the basis of the existing survey. The respective responsibilities of garden owners and the State for the maintenance of the tidal [312] creeks off the Shatt el Arab, from which the gardens are largely watered,

* A commutation of the Government crop share on date gardens into a tax assessed by quality and area, carried out in 1871. A jarib=3937 square metres, or 0·98 of an acre.

2: Dowson G-5 (1929-30) 1932 MH1 Iraq MH1

312 The inadequacy of the existing irrigation system is generally recognised in so far as it relates to the great incompleteness of the network of engineering works needed, such as storage reservoirs, flood embankments, regulator constructions, delivery and drainage channels: but it appears at present to be insufficiently appreciated in the country that the proper utilisation and maintenance of these expensive works is even more important than their construction and probably calls for greater technical skill at the outset. It is a serious mistake to suppose that the management of a great engineering undertaking, such as a national irrigation system, is a simpler problem than its design and construction, or that such management can be economically and wisely left to inexpert hands or to officials primarily occupied with other duties.

243 The primitive methods of cultivation, stock-keeping and disposal of produce prevalently practised, as well as their marked effect on the quantity and quality of the country's output and on its reputation in the world's markets, have been repeatedly emphasised and need only be mentioned here.

439 To build up her prosperity el 'Iraq must evidently develop her export trade both quantitatively and qualitatively. It is therefore of

TABLE IX. MAIN AGRICULTURAL EXPORTS DURING FIVE YEARS 1925-6 TO 1929-30

Product	Quantity in thousands of tons	Value in lakhs of rupees
Living animals (horses, camels, cattle, sheep, goats, etc.)	835·6*	87·7
Raw cotton	3·2	32·7
Dates	624·3	902·1
Grain, etc. (barley, pulse, rice, wheat, etc.)	366·2	449·1
Hides (cow, sheep, goats, wild animal, etc.)	9·3	171·9
Intestines (casings)	0·6	70·1
Raw silk	0·005	0·7
Tobacco	0·8	9·2
Raw wool	32·4	368·2

*Thousands of animals.

great importance to follow the statistics of external trade continuously and to endeavour to adjust the country's agricultural output unceasingly to world demand. Unlike the various land statistics, which have proved so difficult to collect and so unreliable when collected, the Trade statistics kept by the Customs and Excise Department appear not only to be in excellent order but to be used. No attempt will be made to discuss these valuable figures here: but the nature, quantity and value of the principal exports of agricultural products during the five years 1925-6 to 1929-30 in the accompanying table should be noted.

242 It is in experimenting in the culture of new or improved products required by the world, in adapting them to local environment, in multiplying them for local growth, and in demonstrating their successful cultivation and disposal on a commercial scale, that scientific agricultural research stations, progressive landed estates and well-managed marketing bodies, have such an indispensable part to play in the general development of the country's agriculture.

185 The establishment of an efficient national irrigation system and the application of the lessons of progressive scientific research and experience elsewhere must be recognised as two of the fundamental conditions of

3: Clark S-5 (1950) 1951 MH1 Iraq MH1

361 smaller urban and semi-urban communities, the country is
311 essentially rural and dependent upon agriculture. There are, it
312 is estimated, some 35,000 square miles of cultivable land, only twenty per cent of which is cropped in any one year. The country is watered by the two rivers, the Tigris and Euphrates, and is amenable to great irrigational projects. Some large-scale and subsidiary irrigation schemes have been developed and others are under way. Until capital is available, however, to bring much more water to much more land, large areas of potentially arable and pasture land will continue in a state of unexploited fertility.

162 With the exception of a minority who dwell in the towns and smaller urban communities, the population is sparse and much of it mobile. Out of a total population of some 5,000,000 roughly twenty-two per cent live in urban areas, forty per cent in settled rural communities, thirty per cent in semi-settled rural areas, and eight per cent are nomadic.

433 The educational and other social problems and needs of the country can only be appreciated if it is realized that Iraq is predominantly rural in character and modes of life and, minor industries and developing oil projects apart, is dependent upon agriculture for its existence. There is a certain amount of industrial activity connected with drink, tobacco, soap, vegetable oils, foot-wear, bricks and a few cotton ginneries, but, generally speaking, the industrial capacity remains undeveloped. Oil output, however, is rapidly increasing, and the royalties from this industry have already made a valuable contribution to badly needed capital works.

162 Racially, the inhabitants may be roughly divided into seventy-seven per cent Arabs, seventeen per cent Kurds, three per cent Jews, the remainder being Turcomans, Yazidis and Assyrians. The number of Jews has, however, decreased by recent emigration into Palestine. The inhabitants may be further divided into distinctive religious groups, ninety-three per cent being Muslims, three per cent Jews, slightly less than three per cent Christians,
871 the remainder being of miscellaneous faiths. Despite these marked religious differences, a feature of the public educational system of Iraq is its great religious toleration.

181 Generally speaking, although the inhabitants are distributed
153 into distinctive racial and religious groups, they seem to share some important characteristics which, to the educator, are hopeful and significant. A visitor to the country cannot but be impressed with the great natural courtesy, friendliness and open-hearted hospitality invariably shown by people of all ranks and groups. In addition to these socially valuable characteristics, many of the people exhibit a quickness of response which, in those who have passed

6:Ireland S-5 (no date)1937 MHI Iraq MHI

'IRAQ

Irrigation and Agriculture

175* 241 312 In a country so predominantly agricultural as 'Iraq, where rainfall, generally speaking, is too slight for its needs, the provision of irrigation from the rivers, the traditional source of the country's prosperity, remains one of the major problems. The problem of irrigation, however, is more than one of mere extraction of water from the rivers. It is also the maintenance of the natural drainage of the country, its protection from floods and the preservation of navigable waterways.[1]

After the Mongol invasions in the thirteenth and fourteenth centuries, the early irrigation systems, the remains of which can still be seen, collapsed. No government which assumed power was able to maintain canals or regulate the flow of water. Each man did what was good in his own eyes. Many canals silted up. Other canals, cut in the banks by the cultivators, without adequate knowledge or without regard for the future, came to carry more water than the parent river. In many cases, the abstracted water because of improper drainage ruined the land through salination or else filled vast marshes. The rivers, unable to scour their beds in the lower reaches, increased the dangers from floods and hampered navigation.[2]

Not until comparatively modern times were efforts made by the Turks to prevent flooding and to secure the services of engineers to study and to undertake irrigation works. The most prominent of the foreign engineers was Sir William Willcocks who, from his appointment in 1908, studied and proposed schemes for the irrigation and drainage of the country.[3]

[1] *Note on Irrigation in Mesopotamia, December*, 1919 (Baghdad, 1920), p. 9.

[2] Ibid., p. 7; *Brief Note on Irrigation Work in Mesopotamia and the operations of the Irrigation Directorate, M. E. F., up to November*, 1918 (Baghdad, 1919), p. 1.

[3] His programme, in brief, was: the construction of two barrages on the Euphrates at Hindīya and at Fallūja, and two on the Tigris at Kūt and Balad; the construction of a proper canal system from these barrages; the utilization of the Habbānīya-'Abū Dibbis depression as an escape for the flood waters of the Tigris; the regulation of the swamps above Basra; the rehabilitation of the Nahrwan Canal from the Diyālā; and the provision of drainage, escapes and afforestation in connection with the entire programme. Willcocks, Sir W., *The Irrigation of Mesopotamia* (1917, 2nd ed.), pp. 15 ff.

6:Ireland S-5 (no date)1937 MHI Iraq MHI

The Turks, however, lacking both money and initiative for his whole programme,[1] undertook, with encouragement from Great Britain and from Germany, the construction of the Hindīya barrage and the Habbānīya escape of which only the former was completed in 1914.

At the beginning of the Occupation, the interest of the military authorities in irrigation and in agriculture had been confined to restricting the former where it hindered navigation, and encouraging the latter to meet the needs of the troops, although a certain amount of flood prevention work was undertaken from late 1915 onwards. Urgent repairs of the Hindīya barrage and the completion of its canal were also carried out by military engineers in June, 1917, but not until a shortage of local food supplies for the army and later for the civil population was threatened,[2] was the extension of agriculture by means of irrigation taken seriously in hand through the Agricultural Development Scheme, put forward by Mr. C. C. Garbett, First Revenue Officer, July, 1917.[3] 'The plan was to complete canals left half finished by the Turks, dig new ones, improve old ones, to import and advance to the cultivators plough-cattle and seeds'.[4]

The Scheme was only partially successful, the new acreage brought under cultivation, 319,152 acres, being only a little more than half of the original estimate of 606,000 acres.[5] It had been calculated that 280,000 tons of grain would be produced.[6] Actually between 50,000 and 60,000 tons for the

[1] Sir William Willcock's estimate for his programme was £T29,105,020 or about £26,537,000. He anticipated the return would be about nine per cent. *The Irrigation of Mesopotamia* (1917, 2nd. ed.), p. 52.

[2] *Revenue Report*, 1918, p. 2; Hewitt, Sir J. P., *Report for the Army Council on Mesopotamia* (1919), pp. 4, 6, 9.

[3] See minutes of Conference, August 10th, 1917, which formally proposed Scheme. Hewitt, op. cit. App. 5, p. 44. The War Office approved of the Scheme on September 16th, 1917; ibid., p. 5. See also *Revenue Report*, 1917, p. 28.

[4] Ibid., p. 3.

[5] *Brief Note on Irrigation Works in Mesopotamia to November*, 1918, pp. 3-4, 7.

[6] *Final Report of the Agricultural Development Scheme* (Baghdad, 1920), p. 3.

6:Ireland S-5 (no date)1937 MHI Iraq MHI

army,[1] besides supplies for the civil population were obtained. More valuable than the actual amount of the supplies and the consequent reduction of prices and economy of shipping were the political effects of averting a threatened famine, of the show of encouragement to agriculture and the hold acquired over the shaikhs and the tribes of the regions opened up by the Scheme.[2]

The Irrigation Department was taken over by the Civil Administration, April 1st, 1919.[3] The Acting High Commissioner, envisaging, no doubt, a long period of British control, advocated immediate caution and retrenchment. He recommended concentration of 'attention on securing and improving already existing systems where necessary' on the grounds that 'shortage of labour alike for construction and cultivation and financial stringency makes it impractical and inexpedient to open up considerable fresh areas for cultivation'.[4] The arguments of the Acting Civil Commissioner as well as the 'small and unambitious programme of minor works'[5] evolved under his direction and centring about the gradual establishment of the natural regime of the rivers,[6] were, no doubt, believed to be in accordance with the needs of the moment. Colonel R. G. Garrow, Officiating Director of Irrigation, had estimated that the existing population could cultivate approximately 1,500,000 acres of which approximately 1,320,000 acres were to be in cultivation by the end of 1919.[7]

Nevertheless, the policy as enunciated and the programme as

[1] Hewitt, op. cit., p. 13, gives 56,472 tons. See also *Review C. Admin.*, 1914-1920, p. 80; *Revenue Report*, 1918, pp. 2-3.
[2] *Final Report*, p. 1; *Revenue Report*, 1918, p. 2; Hewitt, op. cit., p. 9.
[3] *Irrigation Directorate, M. E. F., Admin. Report for period 1st April to 31st December*, 1919 (Baghdad, 1920), p. 4.
[4] Memorandum, A.C.C. to D.Q.M.G., Baghdad, December 27th, 1918. Also *Draft Report Covering the Last Ten Years of the Work of the Irrigation Department, 'Iraq, dated Baghdad, 14 May*, 1931, para. 3 (hereafter, *Draft Report*, 1920-30).
[5] *Irrigation Directorate, Admin. Report*, 1919, p. 2.
[6] Memorandum, Col. R. G. Garrow to D.Q.M.G., Baghdad, in *Correspondence Regarding Post-War Irrigation Policy in Mesopotamia*, 1919 (Baghdad, 1919), p. 9. Also, *Handbook of Mesopotamia*, p. 171.
[7] *Correspondence*, p. 2.

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a means of establishing a class of independent peasant landowners capable of earning a decent livelihood. Official estimates indicate that the amount of "cultivable" land is almost three times that under cultivation. The criteria used in determining the cultivability of land have, however, probably varied widely. Thus part of the cultivable land in the so-called rain-fed zone in the north may well be in areas sub-marginal from the standpoint of rainfall. As soon as possible the government should classify the cultivable land which is not presently cultivated by types of soil and determine what measures are required in each instance to put the land under cultivation, e.g. whether the land must be reclaimed by drainage and whether, if the land needs to be irrigated, the irrigation should be by pump or by flow.

Most of the area which can be put under cultivation will require water, yet, under current conditions, the supply of water does not even permit the effective irrigation of the area already in use. Projects for the storage of the excess water which pours down the Tigris and Euphrates rivers during the spring flood season and frequently unloosens destructive floods are clearly essential. The government has already initiated work on the Habbaniya Lake storage scheme for the Euphrates River and has let a contract for the first stage of the Wadi Tharthar flood control project on the Tigris River. The program of the Development Board also makes provision for storage dams on two tributaries of the Tigris, the Lesser Zab and the Diyala River. While the Derbend-i-Khan dam on the Diyala River will provide primarily for the more effective irrigation of land already under cultivation, completion of the Dokan dam on the Lesser Zab and of the Habbaniya Lake project should provide enough water to extend the cultivable area under irrigation from about 11 million donums at present to approximately 15 million.

The Mission fully endorses these projects (see map), with the proviso that borings prove the soundness of the Dokan dam site. At the same time it recommends that they be complemented by the construction at an early date of the Bekhme dam on the Greater Zab River for which no provision has yet been made. This dam would compensate for the diversion of the Lesser Zab water from the Tigris by the Dokan dam. Without the Bekhme dam the

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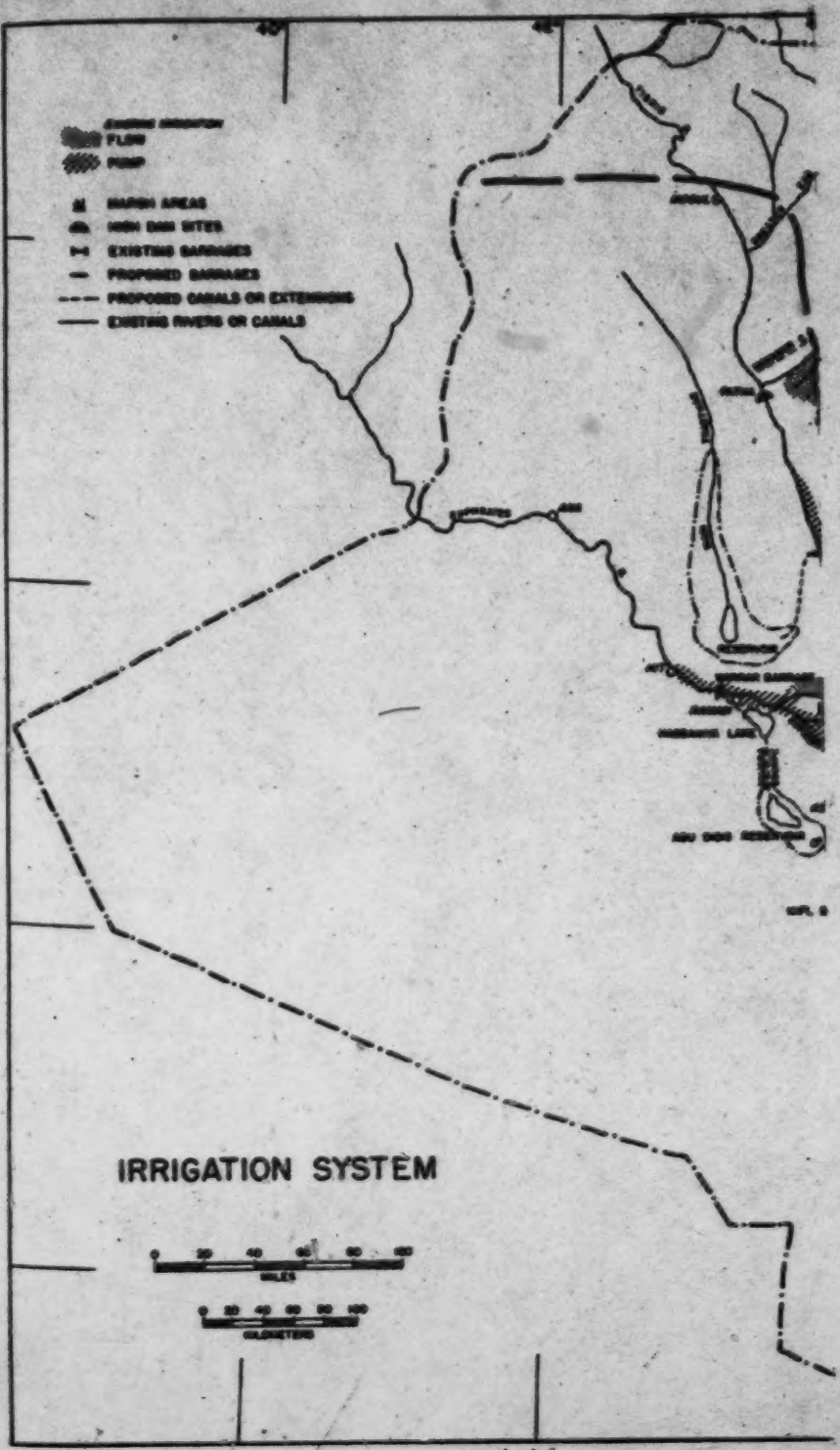

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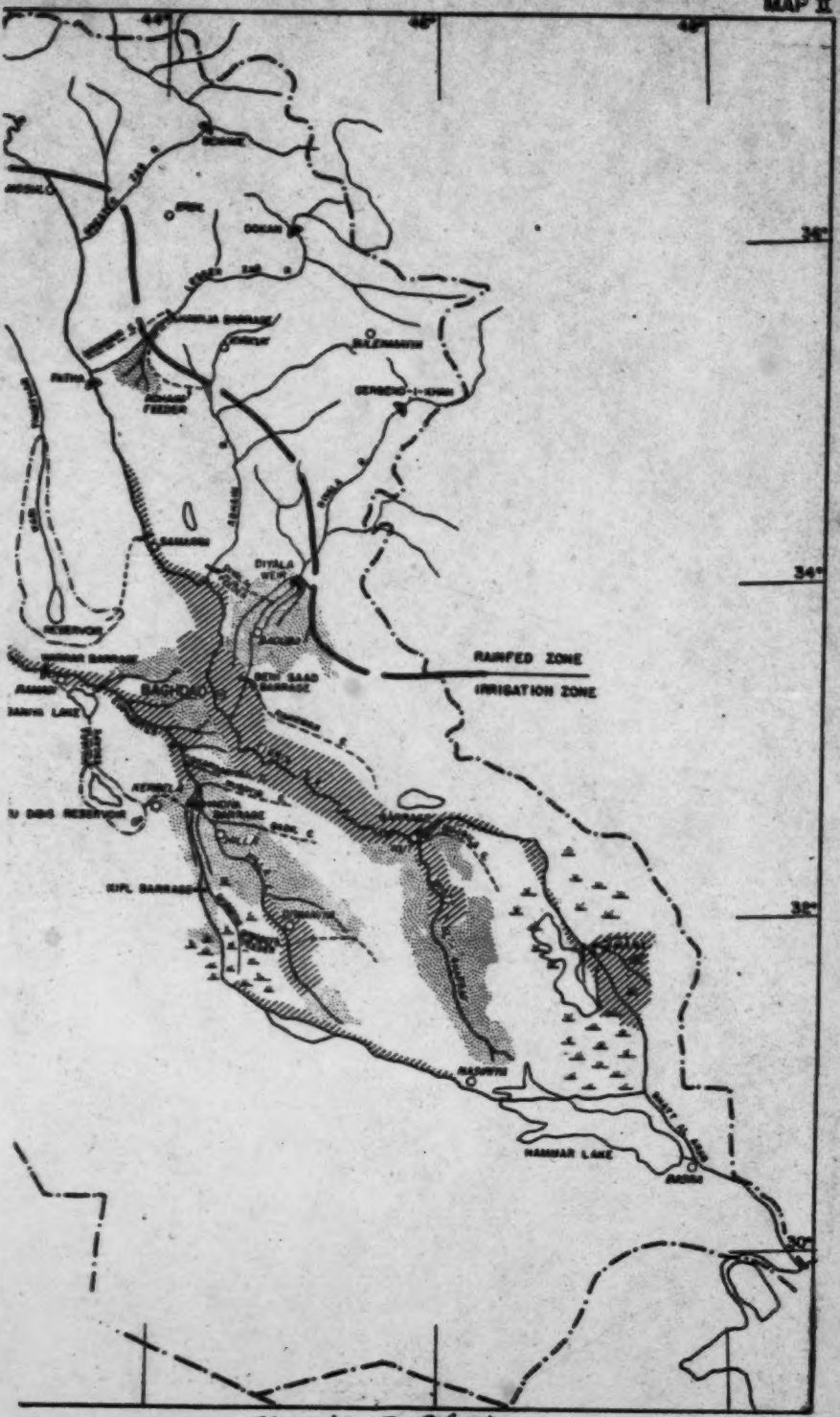
MAP II



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already existing water shortage in the Kut and Amara regions in southern Iraq would become more acute. Its construction is all the more urgent because the Wadi Tharthar reservoir will not supply supplementary water for the Tigris for another decade at best. In fact, some geologists believe that loss of water in the reservoir may be such that little or no water for irrigation will ever be furnished by the Wadi Tharthar. Should the Wadi Tharthar ultimately prove able to supply water for irrigation, the water impounded by the Bekhme dam could be utilized for the irrigation of the Erbil plain in northern Iraq.

Completion of the final stage of the Habbaniya project calls for the storage in the Abu Dibis and related depressions of water in excess of the expanded capacity of Habbaniya Lake and, in theory, would also permit a substantial extension of irrigation in the Euphrates Valley. Further study is required before beginning this stage of that project, however, because there is great danger that the salt in the depression may make the water unfit for irrigation, or at least dangerous to use, until after the completion of drainage facilities for all the areas irrigated from the Euphrates. At the same time the technical possibility of providing alternative storage capacity through the erection of a dam on the upper Euphrates near Ana should be explored.

The irrigation projects outlined above necessitate agreements with Syria, Turkey and Iran regarding the conservation and utilization of the water of the Euphrates and the Tigris and their tributaries. An agreement with Syria is particularly urgent, since the extensive irrigation development possible in that country might adversely affect Iraq. With Turkey and Iran it is important to conclude understandings for joint afforestation and other water conservation measures in the watershed of the Tigris and its tributaries. Afforestation and other anti-erosion measures in the international watersheds of the two rivers will effectively complement the flood-control features of the water storage schemes.

In the monograph on irrigation the Mission has given a tentative selection of the irrigation projects which it believes should be initiated to utilize the waters of the new reservoirs. In view of the inadequacy of the information at its disposal, the Mission suggests, however, that its recommendations be reviewed in the light of a

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number of factors including (1) the cost and the technical aspects of the irrigation works, (2) the agricultural potentialities of the land affected, (3) the location of the land in relation to the availability of potential settlers, and (4) the ownership of the land. The first three of these need no elaboration. The fourth is important primarily because, provided adequate consideration is given to the first three factors, it would presumably be desirable to give priority to the irrigation of those lands which are clearly part of the state domain and which therefore would be available for distribution to small-holders.

Before laying out new irrigation projects the basic premises on which such projects have been designed in the past should, we suggest, be re-examined. Hitherto such projects have been laid out on the assumption that half of the area devoted to the cultivation of winter crops would lie fallow annually. The area in summer crops has not been considered since, in the absence of water storage facilities, the amount of water available limited the area that could be devoted to summer cultivation to about 15 to 20 percent of that in winter crops. The fallow system was regarded as necessary to permit the soil to rest and recover its fertility and to enable the land to dry out and the water table to sink, thus minimizing to some extent the danger of salinity. In the future the government will have the opportunity, through organized settlement and development of the new land, to prescribe the use of better systems of crop rotation which will more effectively maintain soil fertility; and the simultaneous installation of drainage facilities, now universally acknowledged to be essential, will prevent salination. At the same time the completion of the large storage projects will presumably permit some control over the distribution of water for winter crops on the one hand and summer crops on the other. Thus it will be desirable to determine, within the limits of flexibility set by the available water supply, the proportion of winter to summer crops which promises the largest overall yield, having regard both to improved crop rotation and to better utilization of manpower on the land. Such a reexamination of the premises on which irrigation projects have been designed in the past may lead to the conclusion that the area to be covered by irrigation canals using a given quantity of water can in future planning be reduced.

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Greater attention should also be paid to measures which would insure more economical use of available water, thereby making possible a further expansion of the area under cultivation in the irrigation zone. Among these are the installation of regulators on the Gharraf canal, for which provision has already been made in the Development Board's program, and more effective regulation of the lower reaches of the Tigris and Euphrates to prevent the dissipation of water into the extensive marshes in the South. Leaks from canals, which are sometimes quite substantial, should be reduced to a minimum, if necessary by lining certain sections of the canals. Above all, the wasteful use of water in irrigation should be arrested. The amount of water used for each crop in Iraq is generally much greater than that in the irrigated areas of other countries. At present, water is used lavishly over wide areas in an effort to wash accumulating salt from the roots of crops. In the end this only accelerates the progressive salination by raising the water table which brings up and precipitates the salt. The installation of drainage facilities which will lower the water table will therefore be the most effective means of preventing wastage of water. There is also an urgent need, however, to ascertain through practical experimentation, carried out under the joint technical supervision of agricultural and irrigation experts, the optimum amount of water required for each crop and to disseminate these findings among the cultivators.

The completion of the water storage facilities and irrigation works mentioned above will undoubtedly create some problems of adjustment. In a few places pump-irrigated lands will have to be abandoned as the consequence of new flow-irrigation schemes, and the people affected will require resettlement. In an area of about 750,000 donums the natural flooding of rice lands practised in some districts will presumably no longer be possible, and new methods of rice culture will need to be introduced. Rice patches will have to be terraced to permit the progressive flow of water from one terrace to the next and fertilizers used in the place of silt to replenish the soil; alternatively, new crops may have to be introduced. In some cases, partial resettlement of the people affected may need to take place. Even under existing conditions, however, problems of readjustment arise. Natural inundation, for example,

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has led to the progressive silting and raising of rice lands, thereby pushing rice culture deeper into the marshes.

Finally, the Mission wishes to emphasize the importance of improved operation and maintenance of existing irrigation works. To insure proper functioning of the irrigation system the canals must be equipped with an adequate system of regulator intakes and distributors. Rational distribution of water is often impeded by ancient water rights which insure some landowners a disproportionately large share. In times of scarcity the apportionment of water is often hotly disputed and subject to favoritism. The right of access to water across the lands of other farmers is inadequately insured. A sufficient number of adequately compensated irrigation officials of acknowledged probity is necessary to a fair distribution of water. They should be assisted by local councils of farmers who would gradually learn to approach the problem of equitable distribution in a cooperative spirit.

Lack of maintenance has been a serious problem in the past. To facilitate maintenance, irrigation systems should be equipped from the very beginning with such works as roads along canals, canal crossings for people and livestock, water-holes and washing places. To insure adequate operation and maintenance in the future, the Mission recommends that the annual budget of the Irrigation Department, which has averaged only ID 270,000 over the last ten years, should be increased progressively to about ID 1,000,000. The technical supervisory and planning staff also needs to be strengthened

The Rain-fed Zone

Except for some areas west-northwest of Kirkuk and the possibility of ultimately irrigating part of the Erbil plain with the water stored behind the Bekhme dam, large-scale irrigation schemes for the North do not appear feasible. Lack of suitable dam sites and topographical difficulties militate against such schemes. Smaller projects, utilizing the water of small streams, springs or wells are possible, however, and these should not be neglected in favor of the more striking, larger schemes. In many parts small streams and springs are already being used, but with direction and stimulus provided by the government these could be improved and many

7: International Bank N, S-4 (1951) 1952 MH1 Iraq MH1

more brought into use. The government should take steps to survey the possibilities for small projects and to provide assistance in carrying them out, thus giving aid and security to the farm population of the North which now feels that its needs have been neglected and overlooked.

In general, however, the North will have to remain dependent on rain-fall to sustain its agriculture. There are apparently still considerable rain-fed areas which can be settled and put to the plow. Particular care should be exercised, however, to insure that the areas are not sub-marginal from the standpoint of either rainfall or fertility and that settlers are really available in the North, which is generally more sparsely settled than the central and southern portions of Iraq. For example, the Mission believes that the prospect of scanty and uncertain rainfall will probably make it undesirable to proceed, except on a very restricted, experimental basis, with the settlement scheme near Balad Sinjar in Mosul province which has been projected by the Agriculture Department.

Settlement of New Land

In the past much of the vacant land available for an expansion of crop production which ostensibly belonged to the state has fallen into the hands of big landowners. The so-called Land Settlement Law of 1932, which inaugurated a cadastral survey for the purpose of settling the past confusion regarding land titles and systems of tenure, facilitated this process. It permitted the land settlement committees appointed to administer the law to grant titles (so-called *lazmah* grants) to people who could demonstrate that they had made productive use of land within the previous fifteen years. In practice, it has been possible to obtain title on the presentation of proof that a crop was produced on the land in one year, and the land settlement committees have occasionally accepted even more tenuous proof of cultivation. In this way many sheikhs and other influential persons have managed to obtain title to large tracts of land without any payment whatsoever. Since the cadastral survey is only about half completed, more land may be preempted in this way unless a limit is set on such acquisitions.

Land definitely adjudged to be state (*miri sirf*) property by the land settlement committees has, however, been set aside for

7: International Bank N, S-4 (1951) 1952 MH1 Iraq MH1

new settlements the government will have a unique opportunity to remedy the shortcomings of the Dujaila project.

Improvement in Productivity

While expansion of land under cultivation, particularly through large irrigation schemes, is essential in the long run to provide for a growing population and to establish a socially desirable class of smallholders, it should not be undertaken without a simultaneous vigorous campaign to increase the productivity of agriculture and livestock. The temptation to neglect such an effort in favor of striking new irrigation schemes should be resisted. Among the measures upon which this campaign should concentrate are drainage, the provision of better tools, seeds and draft animals, the introduction of soil-building and forage crops, the use of fertilizers, the improvement of livestock, the planting of trees and the establishment of an effective extension or advisory service to farmers.

1. Drainage

The drainage of existing irrigated lands would make the most important single contribution to increasing the productivity of agriculture. Moreover, it will also have the most immediate effect since it can be carried out by the government while the success of virtually all other measures to raise productivity depends on the necessarily slow process of persuading farmers to abandon age-old methods of cultivation.

The Haigh Irrigation Commission, which made an extensive study of irrigation and flood control for the government, estimated a few years ago that about 60 percent of the land irrigated by flow had been seriously affected by salt. The Mission's own inquiries and observations indicate that as much as 20 to 30 percent of cultivated land has been abandoned over the last few decades because of salt accumulation, while on a large part of the remaining land yields have declined by 20 to 50 percent and even more. In a number of new irrigation projects such as Hawija and Dujaila salting forced abandonment of part of the land within two years after the schemes were initiated. Drainage, almost totally neglected in the past, should therefore be prosecuted with utmost vigor in the future.

The main drainage canals for the whole irrigation zone have been projected, but it is now necessary to proceed with detailed

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3/2 planning and execution. First priority should be given to the drainage of the areas irrigated by the canals dependent on the Hindiya barrage on the Euphrates. A complete drainage network should be laid out as soon as possible for the Aggar Qub region, where drainage studies have already been carried out, in order to determine through practical experimentation the most appropriate design and spacing of the subsidiary drainage canals. Prompt attention should also be given to the drainage of the Dujaila area in order to halt the rapid deterioration of the land which may otherwise endanger the success of this important social experiment. Altogether the Mission believes that about ID 7,000,000 should be allotted to drainage over the next five years. This compares with a sum of ID 2,000,000 provided in the initial five-year program of the Development Board. So important is drainage that the Mission recommends that it be given priority over new irrigation schemes whenever a limitation of resources makes it impossible to carry out both simultaneously.

Since landowners will benefit greatly from drainage, they might reasonably be required to pay at least some part of the cost. Consideration might therefore be given to the imposition of a levy to pay the cost of subsidiary drainage canals. Construction of such subsidiary canals should not be optional with the landowners because failure to build them across one man's property might deny the benefits of drainage to adjoining properties.

2. Tools and Draft Animals

241 In the recent past much stress has been placed in Iraq on agricultural mechanization. In large parts of the country, particularly in the dry-farming zone, natural conditions are undoubtedly favorable to the use of tractors. The use of threshing machines or combines has also been shown to have the advantage of producing a far cleaner grain than that obtained through the customary method of threshing by flaying and the tramping of animals. For a long time to come, however, the great majority of Iraqi farmers will be unable to afford the purchase or rental of power machinery even on deferred payment; and many others will find mechanized farming unprofitable particularly as long as the cost of machinery remains so high in relation to the cost of labor. For most farmers the provision of simple tools as well as more and better draft ani-

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by a snail living in irrigation canals, can be combatted by elimination of stagnant, polluted water in which the snail thrives and by treating canals twice yearly with copper sulphate. DDT spraying and the elimination of stagnant water assist in the reduction of malaria. In order to combat both malaria and bilharzia, major irrigation canals should be designed so as to maintain a rate of water flow no less than three miles per hour, and minor distributory canals so as to insure rapid drying-out after use. It is important that one complete "dry-out" per week be enforced in every section under irrigated cultivation.

Knowledge of such methods of combatting disease is already available in Iraq. What is needed is wider dissemination of the knowledge and a vigorous campaign to give it effect. The Endemic Diseases Institute in Iraq has done much useful work in this field but it has been handicapped by insufficient transport, supplies and technical personnel. In the future there will be no justification for denying the Institute adequate funds for its work. It would be well to organize special campaigns in those provinces or districts where the incidence of a particular endemic disease has been especially high. Such a campaign would involve a simultaneous effort to treat the people already afflicted in the locality and to teach local officials and the local inhabitants in general the appropriate preventive measures. Mobile dispensaries and mobile vans equipped to show educational films would be especially useful for this purpose.

Curative Services

On the curative side, principal emphasis must first be placed on the improvement of existing hospitals and an expansion in the nursing service. In its five-year program the Development Board has allotted ID 3,800,000 for medical service buildings. The Mission believes that a large part of this sum should be used to modernize, extend or replace existing hospitals and improve their facilities for diagnosis and treatment rather than to construct additional hospitals. In the monograph on public health the Mission has listed the most urgent projects of this kind which it suggests should be undertaken in adition to those for which provision was made in the first annual budget of the Development Board. While the number

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relieved by low ranges and depressed areas of which the major one is the Wadi Tharthar. It is sparsely inhabited by pastoral nomads although in the North some settled farming, made speculative by irregular rainfall, is carried on.

The second region, extending downstream from Ramadi on the Euphrates and Baghdad on the Tigris and including the Diyala River Valley, is the area where most irrigation projects have been carried out in the past. Pump irrigation predominates on the banks of the three rivers where the land is high and water is easily accessible. For the more remote areas flow irrigation is provided by canals dependent on the Hindiya barrage on the Euphrates, the Kut barrage on the Tigris and the Diyala weir on the Diyala River. Here flow irrigation between the two main rivers is facilitated by the fact that in the Baghdad region the Euphrates is higher than the Tigris, while below Baghdad the Tigris is above the Euphrates. In this region barley is the principal winter crop, followed by wheat. Summer crops are limited by lack of water, but among them cotton has become in recent years by far the most prominent, leaving sorghum, sesame, green gram, corn and millet far behind. Fruit culture is important. Dates are widely grown, both for domestic consumption and for export; and the Diyala Valley in particular produces excellent citrus fruit. Rice is an important crop between Nejf and Diwaniya on the Euphrates and around Rumaitha farther down the river. The country's major concentration of population lies in the region comprising the district about Baghdad and the provinces of Hilla, Kerbela and parts of Kut and Diwaniya. It includes the capital, Baghdad, a city with a population of 550,000 and the leading commercial and industrial center of the country.

The third region—the Basra, Nasiriya, Amara triangle—is generally one vast marsh during the spring floods. Here the rural dwellings are of reeds and brushwood, in contrast to the rest of the country where mud huts and, in the mountains of the North, stone houses predominate. Rice grown in the naturally inundated marshland is the staple food, varied by fish; and the water buffalo is the prevailing type of livestock. Here also is the world's largest date palm belt stretching along both sides of the Shatt al Arab and contributing one of Iraq's principal exports. Basra, Iraq's only port, is the largest city of this region and handles most of the country's foreign trade.

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IV. Natural Resources

Land and Water

312 Aside from oil, water and land may be said to be the principal natural resources of Iraq. Of the two, water is the more critical factor in the country's development. Underground water is generally plentiful, but in parts of the North it is frequently found only at considerable depth and in the central and southern portions, where the water table is high, it tends to be brackish and unfit for consumption. In the two major rivers, however, Iraq possesses a source of abundant water of a quality excellent for irrigation and, with purification, for human consumption. Here the chief problem lies in the marked variation of the flow of the rivers. On the Euphrates the mean monthly discharge of water varies from a low of 293 cubic meters per second in September to a high of 2,235 in May. On the Tigris the variation is even more marked, ranging from a low of 359 in October to a maximum of 2,951 in April. Thus periods of floods alternate with periods of acute scarcity. In the absence of storage facilities and a regulated flow, the limit on the cultivation of crops is set by the current low point in the water supply in the critical growing period for both winter and [134] summer crops. The water problem is further complicated by the fact that continuous use of water for irrigation, coupled with the effect of evaporation in a dry, hot climate, has saturated the subsoil waters with salt and raised the water table, thus precipitating salt which, in the absence of drainage, quickly makes the land infertile. More effective use of the water supply is thus the central problem of Iraq.

311 In relation both to the population and the land actually under cultivation, the amount of cultivable land available in the country is very large. Accurate statistics on the total cultivable area are lacking, but the following estimates based largely on data supplied by the Department of Agriculture give some conception of the magnitude:

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ANNEX B

FLOOD CONTROL, IRRIGATION AND DRAINAGE

Effective and economical utilization of available water resources is the central problem of Iraq.[1] In its study of this problem the Mission has addressed itself to (1) the storage of water for the purpose of controlling floods and increasing the regular supply of water for irrigation, (2) the expansion of irrigation, (3) the provision of drainage to prevent deterioration of irrigated lands by salt, and (4) questions of operation and maintenance of irrigation systems. The Mission has relied heavily on published materials ranging from the *Report on the Irrigation of Mesopotamia* by Sir William Willcocks, published in 1911, to more recent studies, particularly the monumental *Report on the Control of the Rivers of Iraq and the Utilization of their Waters* made in 1949 by the Irrigation Development Commission under the presidency of Mr. F. F. Haigh. In addition, however, the Mission conducted a field survey, in the course of which one or more of its members visited the sites of proposed dams and reservoirs, and examined the problems of irrigation at first hand. Its conclusions are therefore based on observation as well as the study of relevant documents.

I. Water Storage

Today the storage of the flood waters of the Euphrates and Tigris and their tributaries is the foremost problem. The twin rivers carry, on the average, almost 70 billion cubic meters of water per year—a quantity theoretically adequate to irrigate vast areas. Much of this comes, however, in the spring at a time too

[1] See the Mission's main report, p. 7 *et seq.*; also Annex A, *Basic Factors and Conditions*.

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312 late to benefit winter crops and too early for summer crops.
133 Destructive spring floods are apt to occur just before the harvest-
[731] ing of the winter crops begins and as the planting of summer crops is in process. In the dry season—July to December—which is critical for both summer and winter crops, the mean discharge of the Euphrates at Hit and the Tigris at Baghdad is only 421 cumecs (cubic meters per second) and 559 cumecs, respectively, as compared with 1,765 cumecs and 2,572 cumecs during the three peak months of the spring.[2] The Haigh Commission has calculated that the mean discharge which can be relied upon for irrigation is only 280 cumecs for the Euphrates and 350 cumecs for the Tigris and its tributaries. This supply would appear to be barely equal to the water needed for existing irrigation systems when figured on the basis of the standards usually applied in Iraq. In fact, at present there is an acute shortage of water in the irrigated areas of the Diyala Valley and the Hilla canal system while in other areas water is wasted. Short of radical economies in the use of water, which can only be realized over the long term, no significant extension of the irrigated area can be undertaken without controlling and regulating the flow of the rivers. Nor can disastrous floods be controlled without schemes for the storage of the excess waters.

The Euphrates

653 A project for the regulated diversion of the flood waters of
312 the Euphrates into Lake Habbaniya is already under way. This project involves the construction of an inlet channel from the Euphrates near Ramadi to the lake as well as an outlet channel for the later release of the stored waters. A barrage will be built across the Euphrates at Warrar to raise the water level and thus permit an increase in the capacity of the lake reservoir. The outlet channel and regulator are already finished and work is well advanced on the inlet channel and its regulator. The project when completed will reduce the flood discharge from a possible maximum of 5,200 cumecs to 2,000 cumecs and will increase the minimum supply of water available for irrigation from 280 cumecs to perhaps 440 cumecs. The total cost is estimated at ID 4,300,000.

[2] See chart and also Tables I and II in the appendix.

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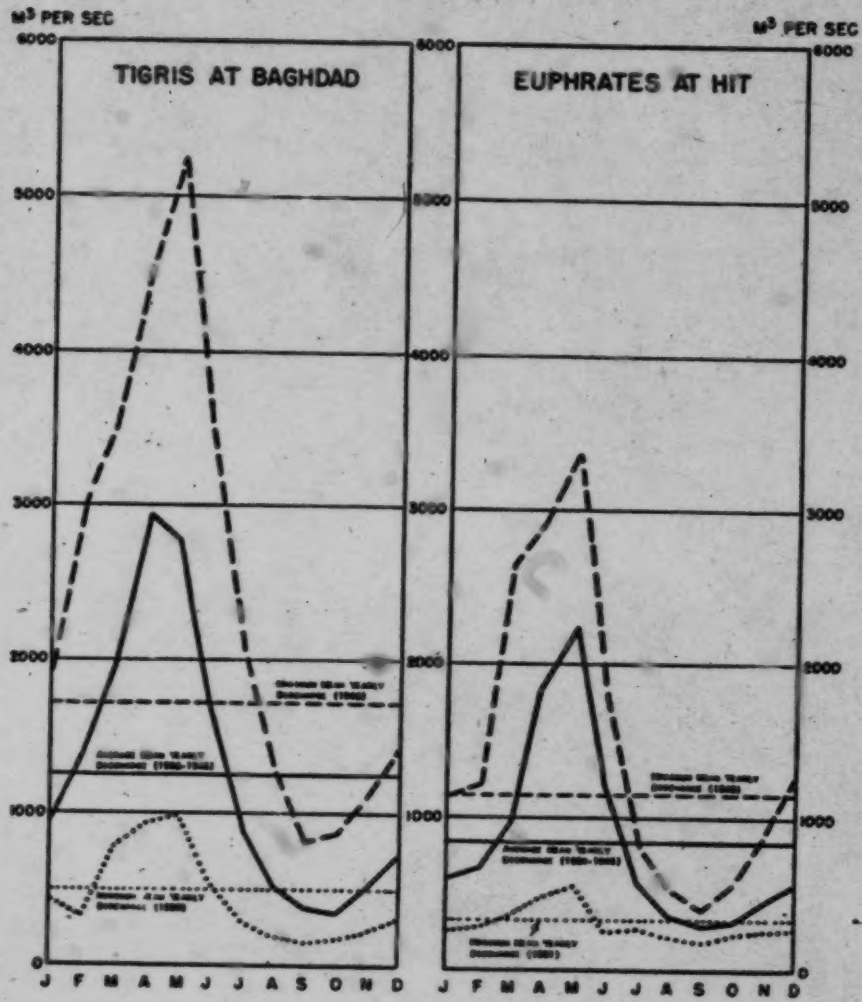
HYDROGRAPHS OF THE TIGRIS AND EUPHRATES RIVERS 133 312

——— Average Mean Monthly Discharge

– – – – Minimum Mean Monthly Discharge

——— Maximum Mean Monthly Discharge



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While the soundness of the scheme is beyond question, the Mission has serious reservations about extending the storage capacity of the project by evacuating part of the water in Lake Habbaniya to the nearby depressions of Bahr el Milh and Abu Dibis through the discharge channel of Mujarrah. The Haigh Commission contemplated that with the reservoir formed by these depressions the maximum flood discharge could be further reduced to 1,500 cumecs and the water available for irrigation could be raised to 510 cumecs. In the opinion of the Mission, however, the salt in these depressions would be a serious obstacle to their use as a reservoir for irrigation water. The use of the stored water of Lake Habbaniya would in itself tend to raise the salt content of the Euphrates to the maximum concentration considered usable for irrigation. Since the lake is said to contain about two million tons of salt, and the waters of the Euphrates entering the lake themselves contain some salt, the waters of the lake at the capacity set by the 49.5 meters contour may reach a salt content of 100 parts per 100,000. These waters when mixed half and half with those of the Euphrates, which have a maximum salinity of 40 parts per 100,000, will tend to have a salt concentration of 70 per 100,000 or approximately the maximum tolerance. The Bahr el Milh and Abu Dibis depressions, however, now contain about 44 million tons of salt. The 20.5 billion cubic meters of water which might be stored in these depressions would therefore have a salinity of 215 parts per 100,000. It would be necessary to remove 27 million tons of salt in order to reduce salinity to 80 parts per 100,000. The Haigh Commission thought it possible to achieve this lower salt content in approximately four years by progressively evacuating the stored water into the Euphrates, but at a rate which would not raise the salt in the Euphrates itself over 80 parts in 100,000. Even granting this possibility, the Mission believes, however, that the resulting salt content would still be too high for irrigation water.

As a minimum, the Mission strongly suggests that any project for storing water in these two depressions be deferred until the problem of salting, already acute, has been brought under control by the installation of drainage facilities in the irrigated areas of the Euphrates Valley. At the same time it would be advisable to explore the possibility of alternative storage capacity somewhere

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along the Euphrates. Of several possible sites, the best appears to be at Rawa, a few kilometers upstream from Ana. There a dam 35 to 40 meters in height could be erected to create a reservoir with a capacity of seven billion cubic meters and an area of 480 square kilometers. The water would be backed up over a distance of 200 kilometers of which 60 kilometers would be in Syria. No geologic study of this possible dam emplacement has been made. An examination of outcroppings shows a series of horizontal layers in which soft but fairly compact limestone alternates with layers of highly decomposed rock and layers of soluble gypsum. While these surface indications raise serious doubt concerning the watertightness of the possible reservoir, the Mission urges that a geologic study of the site, supported by soundings, be carried out in order to obtain a geologic cross-section in the neighborhood of the projected dam emplacement.

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The Tigris

Flood control on the Tigris is to be assured by the Wadi Tharthar project. A contract for the work on part of this scheme was awarded in the fall of 1951. The project involves the erection of a barrage across the Tigris, north of Samarra, to limit the flood discharge of the river to about 3,500 cumecs and divert the excess waters via an inlet channel into the Wadi Tharthar depression. At a contour of 60 meters the depression is expected to hold about 68 billion cubic meters of water in a reservoir extending over 2,050 square kilometers. The total cost of this project, for which the International Bank for Reconstruction and Development provided a loan of $12,800,000 in June 1950, has been budgeted by the Development Board at a figure of ID 9,625,000.

The efficacy of the Wadi Tharthar as a flood control scheme is clear. That the depression is sufficiently watertight to store enough water for irrigation is less certain. The Haigh Commission and its geologist had no doubt on this score, but other experts, including the one who served as government geologist until recently, have raised serious questions regarding the tightness of the reservoir. Two firms of consulting engineers—Messrs. Coode, Vaughan-Lee, Frank and Gwyther, and Sir William Halcrows and Partners—have advised that the Wadi Tharthar project be considered exclusively for flood control. In any event, it would take about ten years

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for the reservoir to fill to the level at which water might be supplied for irrigation, and this water would then be available only for use in the Tigris Valley from Baghdad south. Thus other schemes for the storage of water for irrigation have to be considered.

From time to time storage dams for the Upper Tigris have been suggested, some with the obvious hope that they would cater to the needs of the North where rainfall is unreliable and does not permit the cultivation of summer crops. Among the sites proposed are two north of Mosul. One is near the village of Zumar about 115 kilometers from Mosul. The topographic features there would permit the creation of a storage basin, but geologic conditions appear to be very unfavorable. The soil consists of badly decomposed and fissured Lower Fars limestone and of marl which is also more or less decomposed. While no geologic investigation of the site has been made, borings made by the Mosul Petroleum Company about 10 kilometers away indicate the presence of numerous permeable layers in this area through which large amounts of water would probably be lost. Despite these prima facie doubts about the water tightness of the reservoir, the Mission believes that a complete geologic study, including borings, should be made of the site because of the understandable interest in this project in the North.

Conditions at the second site—Badosh, 25 kilometers above Mosul—are even less favorable. It has been suggested that with a dam 45 to 50 meters high a reservoir with a capacity of five billion cubic meters could be constituted. Outcroppings, however, disclose decomposed limestone with many caverns on this site. The dam would have to be built across a slight fold, cutting through various formations. Even with resort to costly and laborious injections of concrete, it is extremely doubtful that the proposed reservoir could be waterproofed.

Farther down the Tigris there is another possible dam site at Fatha where the river crosses a mountainous fold running northwest-southeast and known as Jebel Hamrin on the left bank and Jebel Mahul on the right bank. This site was studied in some detail by consulting engineers in 1940, and the investigation was resumed by the Haigh Commission in 1948. The Commission's geologist held that it would be impossible to build a gravity dam

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in the gorge itself but that an earthen dam farther upstream might be feasible. The dam would have to be about 3,500 meters long and, with a height of 75 meters and a fall board of six meters, could be used to store 24 billion cubic meters of water up to a contour of 182 meters. It could therefore be considered as an alternative to Wadi Tharthar and even as preferable since it would be likely to make more water available for irrigation. However, the anticipated cost of construction—about ID 20,000,000—and the vulnerability of an earthen dam to enemy attacks in time of war caused it to be rejected. Now that there no longer is any question of its consideration as an alternative to Wadi Tharthar, the possibility of a more modest project at Fatha might well be examined. A dam only 40 meters high could create a reservoir of five billion cubic meters which might some time in the future become of critical importance to irrigation. At the same time it would be so much smaller than the original project that the same objections concerning its safety could hardly be entertained. The Mission would therefore recommend further geologic studies and, particularly, a series of borings to determine definitely a geologic cross-section along the axis of the site.

The Tigris Tributaries

The Development Board has already provided in its five-year program for the construction of the Derbend-i-Khan dam on the Diyala river and the Dokan dam on the Lesser Zab river. The Mission agrees that these dam sites are the best available but suggests, as will be indicated in greater detail later, that these two projects be supplemented by the construction of the Bekhme dam on the Greater Zab river.

The Derbend-i-Khan Dam on the Diyala

Originally the Haigh Commission recommended that a dam be built at a point called Gibraltar where the Jebel Hamrin crosses the river. In 1950, however, Messrs. Coode, Vaughan-Lee, Frank and Gwyther and Sir William Halcrows and Partners expressed their preference for a dam at the Derbend-i-Khan defile farther upstream; and in 1951 the Development Board included this project at a total cost of ID 4,800,000 in its five-year program. The Mission considers this decision sound. The foundation soil at the

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Gibraltar site is soft sandstone sandwiched with layers of impermeable marl. The dam would have to be built of locally available sand and gravel, with an impervious facing in reinforced concrete or an impervious core; and it would be difficult to establish a watertight joint between the impervious facing and the impervious soil through the sandstone. The hills edging the reservoir show many low points where lines of seepage are so short as to create the risk of breaches. The presence of a lot of gypsum adds to the doubt about the watertightness of the reservoir. Moreover, its size and location are such that 128,000 masharas[3] of arable land would be submerged and 35 kilometers of railway detoured.

Borings have been made at the Derbend-i-Khan site and expert geologic opinion holds that the site provides a good foundation for a dam and has possibilities for a watertight reservoir. The rock-fill dam to be built will only close the breach, opened by centuries of erosion, in a solid rock sheath which, over long geologic periods, must have constituted the resistant part of a natural dam. The capacity of the dam will be only 0.87 billion cubic meters as compared with 1.56 billion for the Gibraltar dam. However, after allowing for losses, engineers believe that Derbend-i-Khan will provide a discharge of 80 cumecs at the Diyala weir, which governs the Diyala irrigation canals, as agaist 85 cumecs for Gibraltar. At present the usable mean discharge at the weir is only 38 cumecs.

The Dokan Dam on the Lesser Zab

A short distance from the Iranian border the Lesser Zab River passes through four gorges. According to competent geologic opinion, only the fourth of these, namely the Dokan Gorge, appears to offer a suitable dam site. The Dokan Gorge cuts through about 60 meters of Judean limestone covered by 40 meters of Shiranish limestone. Surface examination indicates that the former apparently consists of horizontal, generally sound beds, interspersed here and there, however, by caverns, while the Shiranish appears to be much more fissured. Up to the present only a brief geologic reconnaissance of the site has been carried out. Borings should be undertaken to confirm the surface indications and determine what special precautions should be taken in building the dam. The

[3] A mashara is equal to a donum (0.25 hectares or 0.617761 acres).

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geologic investigation should extend to the Shiranish limestone, for 312 if this is found to be of adequate quality a higher dam and larger 653 reservoir would be possible.

The construction of an arch dam at this site would be more economical than a gravity dam, but the proper planning and execution of such a dam requires much more skill. The Mission suggests that, after a thorough program of borings have shown the geologic conditions that will be encountered, the design and engineering of the dam should be entrusted to several consulting engineering firms so that the Development Board will be enabled to judge the best of different conceptions. So far as possible, all risks should be eliminated before construction commences. Soundness of conception and safety should not be sacrified in a desire to get things done rapidly.

An arch dam 60 meters in height would provide storage capacity for 1.99 million cubic meters at a level of 501 meters and for 2.21 million at a level of 508 meters. The usable mean discharge of the Lesser Zab would then be raised from about 63 cumecs to 108.5 and 149 cumecs at these respective levels.

The Bekhme Dam on the Greater Zab

The Haigh Commission made a complete geologic reconnaissance, including borings, of the possibilities of building a dam at two different sites in the Bekhme Gorge. It concluded that the Shiranish limestone at the upstream entrance to the gorge would provide a sound foundation for the construction of a high dam. The Commission was primarily interested in this dam as a flood control project, and, after deciding in favor of the Wadi Tharthar scheme, did not therefore include the dam in its program. The Development Board's five-year program also makes no provision for Bekhme.

The Mission urges, however, that construction of the Bekhme dam be undertaken as soon as possible. With the completion of the Dokan dam and related works it is planned to divert the waters of the Lesser Zab into the Adhaim River and use them for irrigating areas on the left bank of the Tigris and in the Diyala River Valley. Thus the Lesser Zab which has a usable flow of about 60 cumecs at present will no longer be supplying water to the Tigris.

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312 653 As a result irrigation in the Lower Tigris basin, particularly in the area served by the Shatt al Gharraf where water is already acutely short, would inevitably suffer in consequence unless water were made available from some alternative source. Although the deficit may be made good from the Wadi Tharthar in the end, it is by no means certain, as has already been pointed out, that the Wadi Tharthar depression will be able to supply water for irrigation. If the Wadi Tharthar reservoir can ultimately supply the Lower Tigris, it will still be possible to use the water stored behind the Bekhme dam for the irrigation of the Erbil plain in the North.

Nor should the cost be regarded as out of proportion to the results that will be achieved. In 1948 Messrs. Coode, Vaughan-Lee, Frank and Gwyther estimated the cost of a gravity dam in concrete at ID 9,000,000, but in 1950 they came to the conclusion that a buttress dam could be built at considerably lower cost, namely about ID 6,500,000. The dam would provide a net storage capacity of 1.66 billion cubic meters and would increase the usable discharge of the river from 128 cumecs to about 240 cumecs. This would furnish additional water sufficient to irrigate an area of two million masharas gross. On this area it would be possible to grow winter cereals on 828,000 masharas which might have a total value of ID 3,700,000, assuming conservatively a yield of one quarter of a ton per donum and a price of ID 18 per ton. If, in addition, summer crops were grown on one third of the area devoted to winter crops and yielded about the same value per mashara, the total value of the crops grown on the area of two million masharas gross could be put at about ID 5,000,000 per year. The resulting increase in national income would far outweigh the cost of the scheme. Even the tax yield would exceed the cost of amortization.

International Agreements

312 648 The construction of these reservoirs makes it necessary to reach agreements with Syria, Turkey and Iran regarding the control of the waters of the Euphrates and Tigris. For the Euphrates this is particularly urgent because half of the course of the river is in Turkish and Syrian territory and nearly all of its basin is in a foreign country. There are irrigation possibilities in Syria which could seriously reduce the flow of water into Iraq. Works which would raise the water level 10 to 20 meters upstream would com-

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mand an area for irrigation of 1,000,000 to 1,360,000 masharas in Syria. Irrigation of 1,000,000 masharas would require a flow of almost 60 cumecs. In Turkey and Iran the mountainous nature of the watershed of the rivers makes it much less likely that significant quantities of water will be diverted for irrigation. With these countries, however, it will be important to reach agreements regarding joint anti-erosion measures. Such measures will effectively complement water-storage schemes as means of flood control, the more so since silting will otherwise substantially reduce the effective life of reservoirs. Cooperation in afforestation of the watershed areas of these rivers is therefore highly desirable.

At present no such agreements exist. With Syria, there is no accord whatever. With Iran, there is only an old protocol of 1914 governing the use of the waters of a small stream, the Gangir. A protocol annexed to the Treaty of Friendship and Good Neighborliness, concluded with Turkey on March 29, 1946, set up a flood-warning service, permitted Iraq to investigate possible sites for flood-control dams in Turkey and gave agreement in principle, subject to confirmation in each case, for construction of works recognized to be necessary. Turkey also undertook to inform Iraq of any contemplated works on any of the two rivers. The scope of the agreement is thus rather limited.

II. Irrigation Works

It is now necessary to consider what irrigation works will be needed to utilize the additional water that will ultimately be made available by the water reservoirs discussed above and what further works should be undertaken to ensure better utilization of water.

Aside from flood control, the most important consequence of the new reservoirs will be the expansion of the area under irrigation. As Table 1 indicates, the area now under irrigation has been estimated by the Haigh Commission at 12,696,000 masharas gross, of which 4,671,000 are irrigated by the waters of the Euphrates and 8,025,000 by those of the Tigris and its tributaries.

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TABLE 1

AREA WITHIN IRRIGATION SYSTEMS
(in 1000 masharas)

	Gross	Cultivated	Winter crop area irrigated	Mean discharge used for irrigation (in cumecs)
EUPHRATES				
Flow irrigation	3,109	2,666	1,160	161
Pump irrigation from canals	607	515	263	32
river	955	812	474	43
Total	4,671	3,993	1,897	236
TIGRIS*				
Flow irrigation	2,380	2,033	760	105
Pump irrigation from canals	1,060	901	400	49
river	3,020	2,567	1,280	115
Total	6,460	5,491	2,440	269
DIYALA				
Flow irrigation	1,350	1,148	572	74
Pump irrigation	215	183	92	8
Total	1,565	1,331	665	82
Grand Total	12,696	10,815	5,002	587

* Including tributaries other than the Diyala.

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312 In considering the areas which might be provided with new irrigation systems, the Mission has adopted certain standards and practices which have been generally accepted in the past. Among these are:

1. The amount of cultivated land (in winter crops) which can be irrigated effectively by a constant flow of one cumec measured at the intake of an irrigation system (i.e. the so-called irrigation duty) is 7,200 masharas or donums;
2. Half of the cultivable area within an irrigation system is left fallow during the winter crop season; and, since a given amount of water can generally irrigate an area in winter crops about four times as large as in summer crops, the area of an irrigation system is conceived in terms of the winter crop;

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3. The cultivable area within an irrigation system is about 85 percent of the gross area which includes the surface occupied by roads, villages, canals, etc.

The Mission does not regard the first two criteria as immutable. The indicated irrigation duty is certainly very low; and the Mission will make some suggestions regarding it in the subsequent discussion of problems of operation. The present fallow system practiced in agriculture should also not be regarded as sacrosanct. Through the use of fertilizers and the introduction of soil-building crops the proportion of fallow might well be considerably reduced. Since almost all of the land which will be newly irrigated will be opened to settlement by small-holders under prescribed conditions, the state will be in a good position to insist on better agricultural practices in such areas. With water stored in reservoirs, it will also be possible to regulate the distribution of water as between winter and summer crops. In the past the amount of water which has flown down the rivers at critical parts of the growing seasons has set an automatic limit on the area both in winter and summer crops. In the future, however, this flow will be subject to control through the release of stored water. The Mission therefore suggests that the government make a special study to determine what combination of winter and summer crops using a given quantity of water would yield the highest output for the manpower employed on the land. The outcome of this study as well as a re-examination of the fallow system may in the end affect the calculations of the gross area which needs to be covered by irrigation works in order to use a given supply of water.

The sequence in which new areas are to be supplied with irrigation is governed partly by purely technical factors. Within the limits set by these technical factors, however, the selection of the areas to be irrigated should take into account the agricultural value of the land, its proximity to potential settlers and its ownership. In making its recommendations regarding new irrigation systems, the Mission has sought to give appropriate weight to all these factors. It was not always possible to arrive at a considered judgment of the agricultural potentialities of various areas, so that on this ground alone its suggestions may be subject to revision. Regarding the ownership of lands which could be irrigated, the Mission had no information. Presumably most of this land is in

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state ownership. In any event, as long as it is technically feasible and not more costly, it will be desirable to give preference to the irrigation of good agricultural land remaining in state ownership because such land can be used for distribution among small-holders.

Expansion of Irrigation—the Euphrates

Except for a narrow band on both banks of the Euphrates between Hit and Hindiya and some smaller areas along the lower Euphrates, which are irrigated directly from the river by pumps, the irrigation systems of the Euphrates are served by a series of canals whose off-takes are above the Hindiya barrage. Nine of these canals serve the left bank of the Euphrates[4]; and only two[5], the right bank. The Hindiya barrage was built primarily to increase the intake into the most important of these canals—the Hilla. This canal, together with its three terminal branches—the Diwaniya, Dagharrah and Hurriyah canals, is supposed to irrigate a gross area of 2,333,000 masharas. The supply of water, however, is sufficient to irrigate only about 35 percent of the cultivable area commanded by the Hilla canal system. It has already been recognized, therefore, that the additional water made available from the Habbaniya should, in the first instance, be used to increase the irrigation intensity in the Hilla canal system to the standard 50 percent. The Development Board has already reserved ID 900,000 to remodel the Hilla canal in order to bring about the necessary increase in its capacity from 114 to 175 cumecs at its head and from 57 to 87 cumecs at its tail. As will be noted below, an additional enlargement of the canal's capacity will be necessitated by further expansion of irrigation. While the Haigh Commission contemplated carrying out the required increase in capacity in two phases and proposed to rely partly on erosion as a means of attaining the needed capacity, the Mission believes it desirable to give the Hilla canal its final outline from the very beginning and to avoid reliance upon the rather erratic effects of erosion. At the same time, the course of the canal should be straightened and precautions taken to reduce losses by infiltration at the resulting low points.

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[4] Saglawiyah, Abu Ghuraib, Yusufiyah, Latifiyah, Iskandiriyah, Musayib, Nasiriyah, Kifl and Hilla.

[5] Husseiniyah and Beni Hassan.

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It has already been mentioned that upon the completion of the Habbaniya project the usable flow of the Euphrates will be raised from 280 to 440 cumecs. Since the Hilla canal area will absorb 30 cumecs, the balance of the increase, or 130 cumecs, will be available for the extension of irrigation to a gross area of 2,200,000 masharas. To use this quantity of water the following irrigation projects are recommended:

1. Extension and enlargement of the Musayib and Iskandiriyah canals to irrigate an additional gross area of 228,000 masharas. The Development Board has already earmarked ID 400,000 for these works.
2. Prolongation of the Babil canal, which is at present only a secondary canal branching off from the Hilla, and increasing its capacity from eight to 65 cumecs so as to provide water for 670,000 masharas gross. For this purpose the capacity of the Hilla canal at its head will have to be raised to 229 cumecs.
3. Construction of a barrage below Kifl on a deviation of the Kufa branch of the Euphrates which would govern, on the right bank, a new canal intended to serve the Bahr el Najaf and, on the left bank, the Shamiya, a branch of the Euphrates which would thereby become a controlled canal with an enlarged capacity of 272 cumecs at its head. This would extend irrigation to a gross area of 590,000 masharas.
4. Construction of a feeder canal connecting the Shamiya with the Diwaniya, one of the branches of the Hilla canal, in order to irrigate a gross area of 385,000 masharas between Shamiya and Diwaniya and deliver a flow of water which would release about 38 cumecs at the tail of the Hilla canal for use elsewhere. This feeder, which would have a capacity of 237 cumecs at its head and of 184 cumecs at its junction with the Diwaniya, would be extended to serve the new Khar canal.
5. Irrigation of a gross area of 108,000 masharas in and immediately south of the Dagharrah canal area by remodelling the Dagharrah Canal and constructing the head of the Khar canal. The additional water for the Gagharrah would come from that released at the tail of the Hilla Canal as a result of the building of the Shamiya-Diwaniya feeder; and that for the Khar canal would come from the expanded supply of the Diwaniya.
6. Additional construction of the Khar canal to irrigate about 220,000 masharas gross.

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312 The Mission suggests that detailed plans of these irrigation works be made as soon as possible in order to make sure that this program is completed by the time the Habbaniya project is finished. Execution of this program will require some agricultural adjustments in the Shamiya area where rice is now grown under conditions of natural inundation. By controlling the Shamiya and installing a flow-irrigation system the area available for winter cultivation will be greatly increased, but at the same time rice cultivation may have to be curtailed. In any event, the fellahin will have to grow rice not on naturally flooded land, but on terraced plots watered successively from canals. At the same time fertilizer rather than silt brought by the floods will have to be used to maintain the productivity of the rice lands. As the Haigh Commission has already noted, these adjustments would in the end have to be made anyway, owing to the progressive silting of the rice lands which is gradually raising them to levels where they can no longer be flooded. The Department of Agriculture should take timely steps to assist the fellahin to adapt themselves to the new conditions.

Other Irrigation Works on the Euphrates

Aside from the works required to expand the area under irrigation, certain other irrigation works on the Euphrates appear to be necessary. The Development Board has already set aside ID 250,000 for improving the Shamiya, one of the branches into which the Euphrates divides below Kifl, and controlling the erosion phenomenon known as the *nagarah* which threatens to dry up the whole rice-growing district of Shamiya. In the Shamiya-Kufa district the flooding and silting caused by the diversion of the Euphrates waters into several branches and numerous canals has raised the river and canal beds above those of the downstream region of Shinafiyah where the waters are once more united in a single channel. During the dry season the remaining water, confined to a narrow channel, rapidly erodes the accumulated alluvium causing a series of falls which move up the canals and tend to lower them to a level where they can no longer be used for irrigation. Regulators to stop this erosive action have been installed on two of the principal canals, but more are needed.

A somewhat similar problem is encountered farther down the river in the rice-growing region above Lake Hammar. Here ero-

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sion keeps the river bed so low in relation to the silted rice lands that the distribution of water in the dry season has become very difficult. The Development Board has provided ID 1,000,000 in its program for necessary control structures on this part of the Euphrates. There has been no agreement as yet, however, on a plan for these works.

Expansion of Irrigation—the Tigris and its Tributaries

Along the Tigris and the Diyala, pump irrigation is much more prominent than along the Euphrates. A large part of the country's irrigation pumps are concentrated on the stretch of the Tigris between Baghdad and Kut.[6] The principal flow-irrigation areas are in the Diyala River and, farther south, along the Shatt al Gharraf. Both these areas suffer from an acute shortage of water. In the North there is a small flow-irrigated area known as Hawija and near Kut an area of similar size fed by the Dujaila canal.

The Derbend-i-Khan dam will not make possible any expansion of the area under irrigation. However, by assuring a usable flow of 80 cumecs, as compared with a present mean flow of only 38 cumecs, it will provide a really adequate water supply over the entire area covered by existing irrigation systems in the Diyala Valley.

The Dokan dam will supply enough water to irrigate about 2.5 million masharas gross. In general accordance with the Haigh Commission's recommendations and the contemplated program of the Development Board, the Mission believes that this water should be used to irrigate new areas on the left bank of the Tigris, both above and below Baghdad, as well as additional areas in the Diyala River Valley. For this purpose, that part of the water supply not used for the irrigation of areas along the Lesser Zab River should be diverted through a new feeder into the Adhaim River; this in turn would be linked by a new feeder to the Diyala River. The latter would then supply the new Nahrwan canal which would be constructed to serve a large area on the left bank of the Tigris below the confluence of the Diyala. The Adhaim feeder should allow for a flow of about 76 cumecs and the Diyala feeder for about 41 cumecs.

[6] For a tabulation of the irrigation pumps in Iraq, see Table II in the appendix.

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312 Irrigation projects for the following areas would then be necessary:

1. Along the Lesser Zab the Makhmur area on the right bank (400,000 masharas gross) and the Hawija area on the left bank (300,000 masharas gross). About 180,000 masharas in the Hawija project are already being irrigated, and work is proceeding on the extension of irrigation to the balance. Both areas would be served by canals governed by a new barrage (Hawija barrage) on the Lesser Zab River which would also control the intake into the Adhaim feeder.
2. On the left bank of the Adhaim River a gross area of 600,000 masharas. To raise the water level for the necessary new canals, as well as for the Diyala feeder, construction of a barrage across the Adhaim will be necessary.
3. Extension of the irrigation system of the Diyala by 540,000 masharas gross.
4. Irrigation of a gross area of 660,000 masharas on the left bank of the Tigris below the Diyala River through construction of the Nahrwan canal and of a regulating barrage just above Beni Saad to govern the take-off of the canal from the Diyala.

This program differs from that recommended by the Haigh Commission in that it does not provide for the irrigation (1) of a gross area of 560,000 masharas on the left bank of the Tigris below Fatha, and (2) of a gross area of 300,000 on the right bank of the Adhaim. The agricultural potentialities of these areas have not been surveyed. A decision to provide irrigation for them should accordingly not be made until it is established that their agricultural value is at least equal to that of the other areas.

[653] In its five-year program the Development Board has already included part of the works for the above projects. This program budgets ID 500,000 for the Hawija barrage on the Lesser Zab, ID 300,000 for the barrage on the Adhaim, ID 500,000 for the Beni Saad dam, ID 750,000 for the construction of part of the new Nahrwan canal and ID 2,600,000 for canal systems in the areas commanded by the Hawija and Adhaim barrages. On the other hand, no provision has yet been made for the Adhaim and Diyala feeders.

The Mission has not attempted to determine which new areas might be irrigated with the additional flow made available upon

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completion of the Bekhme dam. As already indicated, the ultimate choice will depend on whether or not the Wadi Tharthar reservoir will store sufficient water for use in irrigation. 3/2 ●

Other Irrigation Works on the Tigris

Other works are required, particularly to insure more effective utilization of the available water supply. One of the more important problems along the lower Tigris is how to prevent the wastage of water which is sent through Shatt al Gharraf from the Tigris. The Shatt al Gharraf, a former branch of the Tigris, has been converted into a canal through construction of an intake works which in turn is governed by the barrage across the Tigris at Kut. For a distance of 150 kilometers, however, it has no regulators of any kind. This makes it necessary to send through the intake a flow about double what would otherwise be needed and causes a great loss of water at the tail end of the canal. The gross area irrigated from the Shatt al Gharraf is theoretically 2,350,000 masharas of which 1,950,000 are irrigated by flow and 400,000 by pumping. Actually, however, the area in winter crops is apparently only about 700,000 masharas which indicates an intensity of irrigation of only 35 percent as compared with the customary 50 percent. Chronic difficulties are therefore experienced in supplying the requisite volume of water. In order to insure the required supply even for the 700,000 masharas in winter crops it is often necessary in the dry season to close the gates of the Kut barrage for some time, thereby depriving the lower reaches of the Tigris of water and interrupting navigation. The installation of regulators at suitable intervals will make it possible to irrigate the same area with a much smaller volume of water.

The Haigh Commission contemplated the construction of one regulator on the Gharraf, but only for the purpose of governing a new canal which would extend the area under irrigation. The Development Board has set aside ID 450,000 for "construction of regulators on the Gharraf and reclamation of new regions". The Mission urges that the regulators be constructed as rapidly as possible, but suggests caution in undertaking any new reclamation until there is ample assurance that the existing area can be adequately irrigated. Ultimately, of course, expansion of the area

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312 under irrigation may become possible when additional water becomes available either from the Bekhme dam or the Wadi Tharthar reservoir.

Another important project which should be undertaken is the better control of the lower Tigris in the vicinity of Amara. For a considerable distance above Amara and in the immediate neighborhood of that city, the Tigris is progressively impoverished by a series of outlets which can hardly be called canals but which, owing to inadequate control, divert a large portion of the river waters into the marshes. One of the largest of these outlets is the Musandaq on the right bank of the river. This outlet takes off the flood waters of the Tigris up to a maximum capacity of 2,000 cumecs and is normally sealed off in the dry season by a dike. After breaching by a flood, however, the dike cannot be rebuilt except at a time of low water long after the flood peak has subsided. In the intervening period much valuable water is lost. Near Amara the Buteira, Mushara and Kahala canals, with capacities of 1,000, 100 and 450 cumecs, respectively, further deplete the water supply in the Tigris. Farther downstream still more canals, of which the principal ones are the Tabar, the Majar el Kebir and the Michiriyah, deprive the Tigris of water. While all these outlets or canals benefit rice cultivation, they also submerge much land suitable for cultivation of other crops and result in immense losses of water. It is therefore necessary to devise a control program which will prevent the flooding of cultivable land, drain and make available for cultivation the extensive marshes on both banks of the Tigris below Amara, and keep enough water in the Tigris to maintain navigation. The Haigh Commission gave a brief study to such a program, the cost of which is estimated at about ID 3,000,000; and the Development Board has set aside ID 1,2000,000 for the "construction of regulators on the Tigris at Amara".

The Mission urges that, as a first step, all the canals branching off the Tigris be equipped with effective intake regulators which would make it possible to control water diversion. First of all, the Musandaq should be provided with such a regulator and the temporary wooden regulator of the Buteira should be replaced. An intake regulator should also be constructed for the Mushara. In addition, dredging of the Tigris might be undertaken in an effort

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to keep the river bed deep enough to prevent the formation of additional outlets at flood times. These measures should then be complemented by a series of small works to provide proper control of the canals themselves. The Mission suggests that no regulator barrages be built across the Tigris itself until the results of these control measures are known. Meanwhile, the program should improve the navigability of the river and assist in draining the marshes.

As in the case of the Shamiya district on the Euphrates, the program for controlling the lower reaches of the Tigris will make adjustments necessary in the rice-growing areas of Amara. Here, too, it is therefore important that the Department of Agriculture provide timely assistance and advice to cultivators in adapting to the new water regime.

III. Drainage

While new irrigation schemes always appeal to the popular imagination, it would be exceedingly unfortunate if they should continue to be carried out, as in the past, to the neglect of essential drainage. Lack of drainage facilities has resulted in progressive salination and deterioration of the soil. In such areas as Hawija and Dujaila salt has become a serious problem within only a few years from the time irrigation was begun. Almost all land irrigated by flow has become salty to some degree, resulting in declining crop yields. The only conspicuous exception is the land in the Diyala River Valley for which the river, which has cut a deep bed from the Jebel Hamrin range to its confluence with the Tigris, acts as a natural drain during the dry season. Pump-irrigated lands generally suffer less from salting, partly because they are higher and thus tend to have better natural drainage and partly because, owing to the cost of pumping, there is an incentive to avoid the lavish use of water which tends to waterlog the soil.

The Haigh Commission estimated that about 60 percent of the irrigated areas have been affected by salt. The Mission's own observations indicated that perhaps 20 to 30 percent of the cultivated land in the irrigated areas has been abandoned during recent decades owing to the accumulation of salt and that yields on the

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312 134 land still being tilled may have declined by 20 to 50 percent. The situation appears to be worst in the regions fed by canals controlled by the Hindiya barrage on the Euphrates. Thus about half of the lands irrigated by the Beni Hassan canal and 40 percent of those served by the Kifl canal have become too salty for winter cultivation.

The waters of the Tigris and Euphrates do not themselves contain excessive quantities of salt. Water is generally regarded as perfectly suitable for irrigation as long as the proportion of dissolved salts by weight does not exceed 70 parts in 100,000. Available analyses of the Tigris at Baghdad indicate that the proportion does not exceed 30 to 33 per 100,000 at most. For the upper reaches of the Euphrates the proportion is the same or even less, but in the lower Euphrates, which receives the drainage waters from the irrigated areas, the proportion may go as high as 90 parts per 100,000 in the fall of the year. (See Table III in the appendix.)

Salt has, however, become concentrated in the subsoil waters. The presence of some of the salt may be due to the fact that much of the land was originally under the sea. In the long run, however, it has been the continuous irrigation or flooding of the soil, combined with the effect of evaporation under the hot summer sun, which has led to a progressively greater concentration. Irrigation and flooding keep the water table high with the result that capillary action brings the water up into a zone where it evaporates under the heat of the sun and precipitates salt. Frequently cultivators resort to lavish use of irrigation water in order to wash the salt away from the roots of the crops. In the end, however, this practice has only worsened the situation by tending to raise the water table still further.

Salt accumulation can be prevented and existing salt evacuated only by digging drainage canals which will lower the water table to a level of 1.5 to 2 meters below the surface where capillary action can no longer be dangerous. Under such conditions water used in irrigation will wash away the salt deposited in the root zone and return it to the subsoil water which will be tapped by the drainage canals. Fortunately the salt found in the soil is not the sodium carbonate or "black alkali" type which cannot readily be washed away by water. Owing to the low level of the land the

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salty water accumulating in the drainage canals will in most cases have to be evacuated by pumps.

Up to the present, drainage has been the subject of little planning or experimentation in Iraq. Mr. J. S. Turcan, the drainage expert of the Haigh Commission, carried out a drainage study for the Aggar Qub region, which is irrigated by the Saglawiyah and Abu Ghuraib canals. It was found that of the total area of 320,000 masharas, 197,000 needed drainage. Experiments indicated that a flow of 1.0 cumec per 1,200 marsharas over a period of two and a half months rid the soil of salt to a depth of two meters provided drains were installed with a maximum spacing of two kilometers and sufficient depth to keep the water table from rising to a level higher than 1.75 meters from the surface of the soil. The cost of a drainage project for this region, inclusive of the cost of a pumping station to evacuate the drainage waters to the Tigris, was estimated at ID 279,000 per 150,000 masharas or ID 1.86 per mashara. Preliminary plans have also been made for the drainage of other areas. One of these was for the area served by the Beni Hassan canal where the drainage of 330,000 masharas was estimated to cost ID 750,000 or ID 2.26 per mashara. The Haigh Commission came to the conclusion that the cost of drainage would average ID 2.0 per mashara or a total of ID 8,160,000 for 60 percent of the area now under flow irrigation.

Drainage might be usefully complemented by steps to line canals at points where there appear to be excessive losses of water through seepage. Such losses may lead to waterlogging of the soil and a resulting rise in the water table. Since Iraq is rich in asphalt, a lining of bituminous concrete might be best.

Deterioriation of land through salting has become such a serious problem that immediate steps should be taken to initiate drainage on a large scale. The Mission urges that work on the main drains be begun as soon as plans can be completed. At the same time complete drainage systems should be laid out and constructed for areas where the salt problem is most acute, notably those irrigated by the canals dependent on the Hindiya barrage. A start might be made with a drainage system for the Aggar Qub region since it has already been carefully studied. Early steps should also be taken to drain the Hawija and Dujaila areas. The

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312 134 experience gained with the drainage systems first completed, particularly with respect to the depth and spacing of secondary drains, will be useful in planning subsequent schemes.

It is important also that drainage facilities be incorporated in any new irrigation schemes. It is always more costly to provide a drainage network for an already existing irrigation system, since it generally involves cutting across irrigation works and splitting up parcels of land. The installation of drainage facilities will be of vital importance for the rice-growing region of Kufa-Shamiya which the Mission recommends converting to a controlled flow-irrigated area. The same is true of the marshy region along the lower Tigris for which the Mission has suggested a number of control works.

The Development Board has allocated ID 2,000,000 to drainage in its five-year program. The Mission recommends, however, that at least ID 7,000,000 be devoted to this purpose over the next five years. Drainage works for the new irrigation projects alone would cost ID 5,600,000 on the assumption that about 60 percent of the area involved would require drainage. The Mission suggests that part of the cost of installing drainage facilities in existing irrigated areas be paid by the landholders who are benefited. This would be an equitable arrangement and need not be unduly burdensome if payments are spread over a number of years. Landowners, however, should not be given the option of participating in a drainage scheme, for the construction of an integrated drainage network requires the inclusion of all the land within a given area.

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IV. Operation and Maintenance

With attention focussed on the construction of reservoirs and new irrigation systems, there is a great danger that maintenance of existing irrigation works will continue to be neglected as in the past. There are many signs of such neglect today. Regulators have fallen into disrepair; canals have become silted and have developed bad leaks. False economies in the original construction and the use of poor materials have often made the task of maintenance more difficult. Thus frequently there has been no provision for roads

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along the banks of main and secondary canals although roads greatly facilitate inspection and maintenance. The facing of the canals adjoining the control structures is often too short for effective protection of both the canals and the control works. The turbulent water coming up against the earthen embankments may then undermine the embankments or even the control structures themselves. Brick, which lacks adequate resistance to shock and erosion, has sometimes been used as a construction material where concrete or precast concrete blocks would have been definitely preferable. In the future, it might also be desirable to try gabions of iron-wire net, weighted with stones and coarse gravel, in facing canals. These have given excellent and cheap protection against erosion in some countries.

Maintenance is also made more costly by failure to provide originally enough canal crossings for livestock and people, as well as places for washing and drinking. Under such conditions canal banks inevitably deteriorate with resulting leaks and the creation of pools of stagnant water. Crossings, which for the most part can be very simple in construction, should be installed near the villages and at points frequented by cattle. Paved fords will generally be best for cattle since they will provide facilities for drinking at the same time. There is also a need to regulate road crossings of small canals and ditches. Such crossings, which are built by the landowners, are often too short and constructed so poorly that considerable water escapes and the approaches to the crossings are reduced to quagmires.

The operation of the irrigation systems, involving the delivery of water to the actual users, could be considerably improved. Fair distribution is undoubtedly made difficult by chronic shortages of water. Whenever water is short, its distribution tends to be hotly disputed. Under such circumstances the influential landowner is often successful in bringing pressure to bear on the poorly-paid irrigation official who is in charge of distribution. Sometimes landowners resort to more direct action by building temporary dams across canals in order to divert more water to their land. Equitable distribution is also impeded by old water rights which are attached to individual land parcels, particularly in the Diyala River Valley, and are transferred with such property. They often confer a right

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312 to use a quantity of water out of proportion to the amount of land
423 to be irrigated; and in times of water scarcity they must be taken into account in rationing the available supply even though an objective appraisal of relative requirements might produce quite a different distribution.

312 A larger supply of water would, of course, minimize the difficulties of distribution set forth above, but in the long run it is also vitally important that economies be effected in the amount of water used. The provision of drainage facilities and the installation of an adequate amount of regulators on canals will certainly bring about substantial economies of this character. The cultivators in Iraq, however, have for many years been accustomed to use water rather lavishly; only demonstration will convince them that they
312 can safely manage with a smaller supply. It has already been
651 pointed out that the irrigation duty is very low compared to that in many other countries. For flow-irrigated lands it is about 16,950 masharas gross (equivalent to 7,200 masharas in crops); for land irrigated by pumps from canals, 19,500; and for that irrigated by pumps from rivers, 26,200. Pump-irrigated lands have a somewhat higher duty because they are generally better drained and therefore less salted and because the cost of pumping encourages economy in the use of water. As far as the Mission is aware, the problem of
312 raising the irrigation duty has not been systematically studied. The Mission recommends strongly that fields be set aside in each irrigation system for the purpose of determining through practical experimentation over a number of years the optimum quantity of water to be supplied to each crop. Such experiments should be carried out under the joint direction of the Agriculture and Irrigation Departments.

In the future it would be desirable to associate the landholders in each irrigation area as far as possible with the operation and maintenance of the irrigation system. Irrigation should be a truly
[476] cooperative venture. The Mission understands that councils of landowners already exist in some districts, notably along the Diyala, to assist irrigation officials in the distribution of water at times of shortage. Such councils might well be organized in all districts and with the broader function of advising on all problems of maintenance and distribution. They could sponsor the experi-

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ments in the best use of water mentioned earlier and could assist in disseminating the findings. They would be an important means of developing the concept of common responsibility for the efficient operation and upkeep of irrigation systems and might ultimately serve also to disseminate information on agriculture.

The legal situation with respect to water rights and the construction, maintenance and operation of irrigation and flood-control works is defined by Articles 1234 to 1238 of the Mejelle, or Ottoman Civil Code, and Law No. 23 of 1923 and its successive amendments. Repeated changes in this legislation have made it difficult to determine the validity of certain provisions. It would be desirable to codify and clarify the legislation and, in the course of such a review, to eliminate some of its defects. It would be advisable, for instance, to ensure a right of passage for canals across the property of third parties with compensation fixed by the Irrigation Department in accordance with defined criteria. At present such a right of passage is recognized but with the proviso that the interested party must buy or lease the necessary land, which, in practice, may lead to extortionate terms. There is also a need for a review of old water rights. While presumably such rights cannot be abolished, the right to use water might well be brought into closer accord with the amount of land to be irrigated.

The law makes the Directorate General for Irrigation in the Ministry of Communications and Public Works responsible for the construction, operation and maintenance of the irrigation and flood-control schemes. In 1949 the irrigation services had a staff of 1,330 persons, classified approximately as follows:

Engineers	26
Assistant engineers	20
Overseers	94
Office personnel	250
Bund personnel	820
Specialists	120

On the whole, there is an insufficient number of competent, experienced engineers; and pay scales are inadequate to retain able men in a service which often entails considerable hardship. The staff in the provinces is generally not large enough to cope with technical problems along with the many administrative questions

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centering particularly about the distribution of water. Young engineers are often sent as beginners to outlying posts where they work without adequate technical supervision. The service has lacked an experienced Chief Engineer who could, through frequent visits in the field, provide advice and guidance and support the staff with the weight of his authority. The Mission understands that such a Chief Engineer has now been appointed. It would be desirable to provide him with several experienced assistants specialized in drainage and irrigation questions.

In the past the planning of new works has been characterized by two defects: inadequate coordination with other government departments, particularly those dealing with agriculture and health, and failure to make full use of the knowledge and experience of the divisional irrigation engineers.

Although irrigation obviously serves agriculture, the Department of Agriculture in the Ministry of Economics has been virtually ignored in the planning of new irrigation schemes. The same has been true of the health service which is vitally interested in the layout of irrigation projects in connection with its fight against malaria and bilharzia. In its capacity as an over-all planning and coordinating agency the Development Board will be able to insist that all interested government departments be consulted in the planning of projects. A committee consisting of representatives of the Irrigation, Agriculture and Health Departments might be established to pass on irrigation and drainage projects and advise on their pricrity.

This committee might be complemented by a technical committee which would direct the experiments to ascertain the optimum use of water, to which reference has already been made, and perhaps to study other technical operating problems.

In the future planning of irrigation works it would be desirable to make greater use of the divisional irrigation engineers in the provinces. These officials have often acquired an experience and knowledge of local conditions which could greatly aid realistic planning.

The cost of new flood-control and irrigation works will in the future be defrayed out of the budget of the Development Board.

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The cost of operation, however, will have to be met out of the ordinary budget. In the past the ordinary budget of the Irrigation Department has been wholly inadequate to insure efficient operation and maintenance of the existing irrigation systems. In the last ten years an average of only ID 270,000 has been spent annually under the ordinary budget.[7] Expenses for operation and maintenance should actually be about 150 fils per gross mashara under flow irrigation. With a gross area of approximately 6,800,000 masharas under flow irrigation, the appropriate total would therefore be about ID 1,000,000 per year, inclusive of the salaries of the requisite personnel. The Mission therefore suggests that the budget of the Irrigation Department be progressively increased to reach that sum within the next five years, with the additional cost to be borne by the Development Board.

V. Costs of the Program

The Mission estimates that the total cost of the over-all program it has recommended would amount over the next five years (1952-53 to 1956-57) to about ID 55,000,000. Of this ID 27,600,000 would be for water reservoirs, ID 7,000,000 for drainage, ID 2,000,000 for improved maintenance and the balance for new irrigation works. A more detailed breakdown is given in Table V of the appendix. These estimates are exclusive of the provision made in the first year's budget of the Development Board. They are based upon cost estimates made in Iraq by the Haigh Commission and others, but make allowances of 10 to 20 percent for intervening price increases. A further rise in prices in the future would, of course, raise the aggregate cost.

[7] See Table IV in the appendix.

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APPENDIX

TABLE 1

Mean Monthly Discharges of the Euphrates and the Tigris

(in cubic meters per second)

Month	The Euphrates at Hit[1]			The Tigris at Baghdad[2]		
	Mean monthly discharge	Maximum monthly discharge	Minimum monthly discharge	Mean monthly discharge	Maximum monthly discharge	Minimum monthly discharge
January	592	1,130	258	947	1,926	432
February	665	1,217	278	1,388	3,020	323
March	968	2,651	344	1,992	3,496	797
April	1,853	2,917	462	2,951	4,541	935
May	2,235	3,358	533	2,775	5,241	997
June	1,208	1,792	249	1,684	3,562	548
July	577	809	268	897	2,069	292
August	358	533	202	504	1,278	192
September	293	383	183	373	827	163
October	311	557	225	359	872	175
November	432	881	247	516	1,105	212
December	558	1,248	264	709	1,413	300

[1] Based on observations over the years 1924-1946.
[2] Based on observations over the years 1906-1946.

TABLE II

Number and Horsepower of Irrigation Pumps as of March 1, 1950

Average capacity of pumps: 1948-49 — 36.22 H.P.
1949-50 — 36.40 H.P.

Liwas	Euphrates and canals		Tigris and tributaries		Diyala and tributaries		Shatt al Gharraf		Shatt al Arab		Total 1949-50		Total 1948-49	
	Number	H.P.	Number	H.P.	Number	H.P.	Number	H.P.	Number	H.P.	Number	H.P.	Number	H.P.
Mosul	—	—	74	2,394	—	—	—	—	—	—	74	2,394	71	2,209
Erbil	—	—	2	68	—	—	—	—	—	—	2	68	2	68
Sulcimaniya	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Kirkuk	—	—	3	44	—	—	—	—	—	—	3	44	2	28
Diyala	—	—	54	2,518	68	3,277	—	—	—	—	122	5,795	115	5,386
Baghdad	139	4,453	1,084	33,475	92	3,852	—	—	—	—	1,315	41,780	1,313	41,849
Dulaim	265	7,904	—	—	—	—	—	—	—	—	265	7,904	268	7,974
Hilla	86	2,032	—	—	—	—	—	—	—	—	86	2,032	75	1,738
Kerbela	30	651	—	—	—	—	—	—	—	—	30	651	29	624
Diwaniya	570	22,610	—	—	—	—	—	—	—	—	570	22,610	477	18,705
Muntafiq	82	3,364	—	—	—	—	24	1,310	—	—	106	4,674	82	3,362
Kut	—	—	451	21,568	—	—	97	4,508	—	—	548	26,076	552	26,115
Amara	—	—	354	13,656	—	—	—	—	—	—	354	13,656	333	13,002
Basra	5	167	12	448	—	—	—	—	101	2,840	118	3,455	106	2,982
Total	1,177	41,181	2,034	74,171	160	7,129	121	5,818	101	2,840	3,593	131,139	3,425	124,042

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TABLE III

SALINITY OF THE EUPHRATES AND THE TIGRIS[1]

(proportion of dissolved salts in parts per 100,000)

Month	Tigris At		Euphrates At		
	Baghdad	Hindiya	Hilla	Samawah	Ur Junction
January	26	9.5	16.7	19.7	20.0
February	26	7.2	16.9	22.6	23.5
March	22	10.7	20.5	21.1	20.7
April	19	7.4	18.0	13.9	20.0
May	19	5.8	18.5	10.3	10.0
June	19	8.3	10.8	10.9	8.0
July	23	9.1	10.2	16.5	14.0
August	28	22.1	22.5	69.0	70.9
September	30	20.7	26.6	90.7	97.6
October	32	26.8	27.0	69.8	82.2
November	33	17.5	19.1	53.3	57.2
December	27	17.1	21.4	57.2	74.4

[1] Data for the Tigris are based on observations over the period 1924 to 1932, but those for the Euphrates on observations over only one year which was particularly dry.

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TABLE IV

Expenditures of the Directorate General of Irrigation

(in dinars)

Fiscal Year	CAPITAL WORKS BUDGET			ORDINARY BUDGET				TOTAL BUDGET
	Capital Works Other than Bunds	Bunds	Total	Irrigation and Drainage	Flood Control	Salaries Allowances Services	Total	
1941-42	247,396	53,295	300,691	63,986	32,566	75,332	171,884	472,575
1942-43	200,328	119,047	319,375	67,971	36,512	95,128	199,611	518,986
1943-44	355,461	152,830	508,291	82,606	22,842	118,598	224,046	732,337
1944-45	448,309	157,986	606,295	74,963	23,266	154,693	252,922	859,217
1945-46	326,975	124,756	451,731	68,077	28,093	157,981	254,151	705,882
1946-47	667,057	337,897	1,004,954	89,965	125,208	201,527	416,700	1,421,654
1947-48	783,139	363,020	1,146,159	86,628	13,318	187,781	287,727	1,433,886
1948-49	1,088,591	230,671	1,319,262	70,765	54,213	206,146	331,124	1,650,386
1949-50	726,224	159,084	885,308	69,924	32,608	189,418	291,950	1,177,258
1950-51	607,481	173,080	780,561	56,926	19,877	193,868	270,671	1,051,232
Total	5,450,961	1,871,666	7,322,627	731,811	388,503	1,580,472	2,700,786	10,023,413

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TABLE V

Estimated Cost of the Program
(in million dinars)

Project	Development Board Program 1951-52 to 1955-56	Mission Program 1952-53 to 1956-57
I. Dams and reservoirs		
Wadi Tharthar	9.62	10.30
Dokan	2.32	2.80
Bekhme	—	7.80
Derbend-i-Khan	4.80	5.10
Habbaniya	2.12	1.56
II. Irrigation works		
On the Tigris and its tributaries		
Hawija barrage	.50	.60
Adhaim barrage	.30	.36
Adhaim and Diyala feeders	—	1.50
Beni Saad barrage	.50	.60
Irrigation systems using Dokan reservoir supply	2.60	5.41
Regulators on the Gharraf	.45	.45
Control of the lower Tigris	1.20	1.20
On the Euphrates		
Remodelling of Hilla canal	.90	.90
Kifl barrage, regulation of the Shamiya, and Shamiya-Diwaniya feeder	.25	1.40
Irrigation systems using Habbaniya water supply	.40	5.18
Regulation of tails of the Euphrates	1.00	1.00
Other irrigation works	.32	—
III. Drainage	2.00	7.00
IV. Improved maintenance and operation	—	2.00
Total	29.28	55.16

7: International Bank N, S-4 (1951) 1952 MH1 Iraq MH1

a greater security of tenure. Other factors, which have no doubt affected the permanence of villages in some parts of the irrigation zone in central and southern Iraq, are the salination of the land and the silting of canals. In such cases, the fellahin have no choice but to abandon their villages.

In spite of these differences, however, the villages have a number of characteristics in common. The typical village is a cluster of huts huddled together without any orderly design. There are no communal facilities or open spaces for the recreation of the children. The huts are so constructed as to keep out heat, cold and sandstorms at the minimum expense. Consequently, they consist of a single room with thick walls and a doorway, which usually opens on a small enclosed yard that is used for both cooking food and keeping draft animals. In order to avoid sand and sunlight, windows are either very small or totally lacking; sashes are expensive. Furnishings are limited to such elementary necessities as a mat and a plain table or a bench. Sanitary facilities, including latrines, are generally lacking.

The villages are necessarily located near a source of water, by a canal in the irrigation zone, by a stream or a well in the North. The water is not piped, but must be carried from its source to wherever it is used. Nor is it purified, although the canals in the irrigation zone may be heavily polluted. The water which has been used by men for washing and in which animals have immersed themselves while drinking is often used for human consumption. The constant trampling of the canal banks for these purposes leads to leaks and, hence, to stagnant pools near the adjacent village. Where the source of water is a well, the earth nearby may be dug out for use in the construction of houses and so, similarly, a stagnant pool may be the result. Such pools, combined with the total absence of any sanitary disposal of waste and garbage, constitute a serious danger to health.

Trees are rarely seen in the villages, although they would give relief from the sun and from sandstorms. Trees would also provide firewood instead of the fuels currently used—animal dung, which could be used instead as fertilizer, and brushwood, which has to be gathered with considerable effort. Small gardens for vegetables are unknown. In fact, fruit and vegetables are almost

7: International Bank N, S-4 (1951) 1952 MH1 Iraq MH1

365 operating is under the control of Municipal Water and Electricity Boards. The Boards appear to be inexperienced in the management of such concerns, financial control being especially inadequate.

Water

• 312 One of the prime requisites of a community is a safe water supply. The principal source of water is the rivers. The Tigris, the Euphrates and their tributaries offer continuous and generous supplies of fresh water during the entire year. Communities have naturally stayed close to these sources of water and close to the many irrigation canals which now extend from the river systems.

While water from the rivers and irrigation canals is fresh (low in salt content), it nevertheless is high in colloidal and organic material, and usually high in bacteria. It is necessary, therefore, to treat such supplies of water for human consumption if general health is to be maintained (see Annex D, *Health*).

There are also a number of communities, mainly in the North, which are not situated near surface sources of water. These have to rely on subsoil water which, although it may be free from pollution, is apt to be brackish.

365 312 The first modern water works was constructed shortly after the first World War. Development in this field has reached the point where approximately 40 municipalities have modern water systems, the outstanding ones being in the larger cities of Baghdad, Basra and Mosul. All water works follow a similar pattern and consist of a raw water pumping station, sedimentation tanks, sand filters, chlorine treating equipment and an elevated surge tank. The capacity of the various water works is usually premised on the basis of 25 gallons per person per day with an allowance for a population growth in 25 years of 1.5 percent per annum.

Administration by the Water Boards has thus far been good. The Boards have established water rates for large consumers on a metered basis, while small consumers receive a flat rate. In either case, the rates are very reasonable and vary from 10 to 30 fils per cubic meter or from 100 to 250 fils per month, where a flat rate is established.

The development of municipal water systems has not taken place as rapidly as it should, primarily because of the lack of suffi-

7: International Bank N, S-4 (1951) 1952 MH1 Iraq MH1

cient funds. The Department of Municipalities, however, anticipating assistance from the Development Board in its financing, has prepared a plan of construction during the next five years which will include the expansion or construction of new facilities in 114 municipalities having an aggregate population of approximately 950,000. The plan is practical and technically follows present methods. Many of the treatment plants are of the same size. This, fortunately, permits standardization which considerably reduces capital costs. The total estimated cost of the program is ID 5,651,600 of which approximately 50 percent would be in foreign exchange, mostly in sterling.

There are numerous villages in addition to municipalities where the problem of obtaining water is very critical. In many cases, this could be relieved by either a single well or by pumping small quantities of water at some distance from streams or irrigation ditches. Such sources of water would in many cases be impure and would require the use of clay filters. Nevertheless, it would relieve the people of the burden of carrying water for human consumption a great distance. These facilities should not cost more than ID 1,500 per installation.

With the need for pure water so critical, it is recommended that the Development Board assist the Department of Municipalities in financing the five-year program for the municipalities. In the meantime, the Department should study the problem of supplying water to the numerous villages and formulate plans for consideration by the Development Board.

Sanitation

Adequate disposal of waste water is an acute problem throughout Iraq and a long-term program needs to be drawn up. Pending this, a start should be made with a sewage system in Baghdad, since the rise in the subsoil waters makes the need of this city most acute. In 1947, an English firm prepared a report on the installation of a sewage and drainage system for the city—complete with pumping stations, sewage purification works, etc., and estimated to cost ID 4,600,000 on the east bank of the Tigris and ID 4,300,000 on the west bank. The proposed scheme could be undertaken in stages.

8:Campbell T-5 (no date) 1949 MH1 Iraq MH1

to him permanently. Women are almost invariably known by the name of their eldest son, preceded of course by Umm. The other extremely common practice is that of giving a man a laqab, or nick-name, from some habit or personal peculiarity. The laqab is rarely complimentary.

8. A Man's Honour is in the Hair of His Moustache

Page 111, Line 14. 'The hub in their house was empty of water.'

The hub is a large porous earthenware jar, which keeps water cool by evaporation.

Page 112, Line 6. 'Nor did he even own the leg of a mare.'

The phrase 'leg of a mare' implies that a man has ownership in a quarter share of the sale price of all foals from the mare. It is quite common for deals to be done in one, two, or three legs of a mare, and for one mare to have four owners.

Page 116, Line 13. 'Then will our sheikh cry, Sheil.'

Sheil, or Take away, is a word commonly used as an order to strike camp.

Page 116, Line 28. 'You should not have to drink the water from a camel's stomach.'

When threatened by death from thirst in the desert, Arabs may be forced to slaughter their camels in order to drink the stomach fluids. I have also been told that travellers have made their camels sick by forcing a stick down their throats to get a little fluid. I do not know if this is true. It would appear to me to be a most difficult operation.

Page 118, Line 29. 'Cut my head to keep the secret.'

This should probably have been more properly translated 'Cut my head off to keep the secret,' for I have since been told one man's version of this saying. According to his account there were three brothers of a famous Nejaf family, living in poverty, and they were forced to become thieves. One day they went to raid a Turkish Army camp near to Hindya. In the daytime they watched the camp and saw which was the guard tent in which the treasure chest was hidden. They then waited till night, and, when the camp was asleep, they

●312 The area of arable land is now estimated at one-fifth of the total area. A new system of irrigation has been put into operation: many canals have been dug; dams have been built, the largest of which are the Kut dam, which is 500 metres long and irrigates 2,225 square kilometres, and the Diyala dam, which irrigates the whole province of the same name; reservoirs and pumps have been installed: in 1946-47, 3,168 pumps, with a total capacity of 111,687 h.p., were in operation in the Tigris basin, 973 in the basin of the Euphrates, and eighty-seven in the basin of the Shatt al-Arab and in the creek of Basra.

241 The main crops are as follows:

1. Cereals: barley, especially north-east of Kirkuk and in the regions of Kut and Muntafiq, south-east of Baghdad, in the irrigated area; wheat, north of Kirkuk (where the best quality is grown), in the regions of Baghdad, Kut and Diwaniya, and also east of Ramadi; rice, in the regions of the lower Euphrates, near Suq ash Shuyukh and east of Nasiriya and the Tigris, south of Amara, and in the districts of Diwaniya and Hilla. In the southern part of the country, maize and millet are also cultivated.

3:Royal Institute of International Affairs U-4 (no date)1954 M1 Middle East
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helminthosis are endemic. There are occasional outbreaks of smallpox, typhus, and more rarely plague and cholera. With the greater provision in the budget for schemes of public health, the increased employment of international specialists and the considerable assistance tendered by the World Health Organization, there is every prospect that the incidence of endemic diseases will be greatly reduced. Fundamental results may be expected from modern medical training, with emphasis on the environmental aspects of disease and the need for prevention as much as or even more than cure, and, above all, from the efforts of the administration to improve the environment itself, with especial reference to drainage and water-supply. In addition, attention is to be paid to the public health aspects of the pilgrimages. The curative services have in general received more attention than the preventive and have improved considerably in the past thirty years. Simple conditions are treated in some 400 state dispensaries, distributed fairly evenly throughout the country but varying in their equipment and staff; it has hitherto proved difficult to attract doctors to the provinces and particularly to the rural districts. Each *liwa* centre has a general hospital, the larger towns more than one. There are also specialized hospitals for maternity and child welfare, for infectious, chest, eye, venereal, and mental diseases, and for lepers. The army, police, railways, Port of Basra, Ministry of Education, and oil companies maintain their own medical services and hospitals, and there are in addition an American Mission Hospital and a number of private nursing homes. A five-year programme, financed by the Development Board, will provide for the repair, extension, and replacement of medical buildings which have become old or inadequate. There is an acute shortage of well-trained nurses; attempts to expand the service are hampered by the reluctance of Muslim girls of good family to enter it.

Education

The state provides elementary, intermediate, secondary, and higher education, all, since December 1952, completely free. There are also private and foreign schools on a kindergarten, elementary, intermediate, and secondary level.

State Education. Primary education, by law universal and compulsory where facilities exist, begins at the age of six and continues for six years. It has been limited by a shortage of schools and trained teachers, especially in the villages. Plans are in hand to meet the need. The rapid expansion of state primary education is demonstrated in the following table:

3:Royal Institute of International Affairs U-4 (no date)1954 M1 Middle East
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185 charcoal production with consequent encouragement of
137 secondary industries, and improve climatic conditions.
313

Problems of Agriculture

185 Among the natural difficulties which attend agriculture in
654 Iraq are those imposed by drought, floods, dust storms, diseases, pests, and soil erosion, of which the first two are being attacked by a large-scale programme of irrigation and flood-control. The major diseases are the inflorescence rot of dates, wilt diseases of tomato and watermelon, gummosis of citrus, rusts of cereals, and various mildews. The major insect pests are the Moroccan locust, whose ravages have from time to time caused immense damage to cereal crops, the grasshopper, the Mediterranean fruit fly, the date-fruit mite and Dubas bug, and the Sunn pest and bug *Aolia acuminata* which attack wheat and barley. The Ministry of Agriculture is combating these diseases and pests by modern methods; in locust-fighting Iraq is among the most advanced countries in the world. The problem of soil erosion can to some extent be met by the activities of the Forestry Department.

Irrigation

312 The aim of water-control in Iraq is to even out the seasonal flow in the two great rivers, Tigris and Euphrates, so as to prevent both drought and flooding in the irrigated areas and to increase the area under cultivation. Irrigation itself imposes the necessity of drainage, to prevent the salting up of irrigated land and the further spread of malaria.

Three methods of irrigation are employed: direct inundation at flood-time, which is used for rice cultivation and is of comparatively limited importance; distribution of water from rivers and canals by direct flow on to the land through a network of small channels and cuts; the lifting of water into the channels and cuts by various methods which include the use of mechanical pumps. The date-palm groves of the Shatt al-Arab benefit by natural irrigation; twice a day as the tide rises and falls fresh water is forced into the creeks and channels and then drains out again.

Irrigation—often highly organized—has been a feature of Iraqi agriculture since the Sumerian civilization, in decline since the seventh century, and especially since the thirteenth and fourteenth centuries. Serious reconstruction began in this century, with the Hindiya barrage, completed in 1913, for which the Euphrates was diverted, and the Kut barrage on the

3:Royal Institute of International Affairs U-4 (no date)1954 M1 Middle East
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Tigris, completed in 1939; both of these control the flow of water and serve extensive irrigation schemes. In 1952 8 million acres of land were under irrigation—five times the area in 1918; in 1949–50 3,600 pumps were in use as against 143 in 1921. Two more major projects are in process of execution: the first on the Euphrates, for which the Habbaniya Flood Relief and Storage Scheme has just been completed, and a barrage across the river at Ramadi is awaiting construction; the second for the Tigris, whose waters will be drawn off into the Wadi Tharthar as a means of flood prevention. Cultivation will be increased by dams at Darband-i-Khan, Bakhma on the Diala, Dukhan on the Lesser Zab, and possibly at Bakhma on the Greater Zab, the first also serving for flood control. Schemes of lesser construction and extension are also being planned and executed for southern Iraq. In all, the Development Board has allocated nearly 53½ million dinars for projects of irrigation and flood control during the years 1951–6, of which 4 million dinars are devoted to drainage.

Land Tenure and Conditions of Cultivation

The system of land tenure and the conditions of cultivation are responsible for a further major problem in Iraqi agriculture. There is very little peasant proprietorship. Much of the land is held on various terms by Arab tribal shaikhs and Kurdish aghas (barons) or by wealthy townsmen, who divide their land in small plots among sharecroppers, to cultivate under the supervision of their agents for a return which may be as little as 30 per cent of the yield. Of the area covered by cadastral survey, 67 per cent is held in holdings of over 1,000 dunams and 24 per cent in holdings of over 10,000 dunams. Agriculture remains, on the whole, primitive and wasteful in tools and technique because of the lack of interest, on the part of the landowners, in organization and development and because of the ignorance, poverty, and lack of security or incentive—since the landlord secures the advantages of all improvements—of the cultivators. This backwardness is illustrated by the generally low yields. The disadvantages of feudal and absentee land ownership have been perpetuated by the land settlement of the last fifteen years, which, by tending to confirm the existing procedure, has made reform more difficult of fulfilment. The establishment of large farms worked directly by their owners with modern machinery is usually prevented by the almost total absence of a class of farm labourer working for cash wages. The expansion of the cultivated area, particularly in south Iraq, is hampered by the sparseness of population. Labour is specially scarce at harvest

5: Harrison / D-4 (1912-1924) 1924 M1 Middle East
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133 delta of two rivers—the Euphrates and the Tigris. With insignificant exceptions, it is one vast level expanse made up of the rich silt that these rivers have brought down. It contains no physical features whatever that call for comment except the plains and the rivers, unless we mention that combination of plain and river which covers a considerable area, namely the marsh. In the past this district was the seat of some of the great empires of antiquity—Assyria and Babylonia and Persia. When Xenophon marched over it about 400 B. C., it was and had been for centuries one of the world's centers of power and productiveness. It supported a vast population in those days, how vast no one knows, but the ruins of ancient cities suggest that it must have been very great in-
312 deed. The basis of its greatness was the use of the Tigris and Euphrates rivers for irrigation. By this means the whole country had been transformed into one vast garden. The area was not so large then as it is now, for year by year the delta encroaches on the sea. It is supposed that in ancient times the sea reached up as far as Gurna at least, and that is a hundred miles from the present mouth of the river.

Under the Mohammedan caliphs of Baghdad the irrigation dams, waterways and smaller canals that had existed for centuries were allowed to fall into greater and greater decay. The Mongol invasion of Mesopotamia, which culminated in the capture of Baghdad in 1258 A. D., resulted in the complete destruction of this ancient system of irrigation. Ever since it has been in ruins, but the courses of the larger waterways are still distinguishable, and engineers tell us that they can decipher the en-
162 tire system. The country has been a desert since that
311 day, populated by nomad tribes who roam over the vast

* [The Tigris-Euphrates Delta Area -- Analyst]

5: Harrison D-4 (1912-1924) 1924 M1 Middle East
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level plains and raise, by means of the scanty rainfall, a meager amount of wheat and barley in favorable seasons.

Along the rivers in their upper courses are a few gardens, irrigated by means of various draught animals and water-wheels, which elevate water from the stream to the level of the land above. At Gurna the Tigris and Euphrates join to form one river and at Mohammerah the Karun empties into this united stream. The three rivers thus flow into the ocean as one enormous waterway, known locally as the "Arab River." For the last hundred miles before the sea is reached, the fresh water of the river ebbs and flows with the tides, and by cutting outlets along the river banks gardens may be automatically irrigated twice a day if so much water is desired. Along these lower stretches each bank of the river is lined with beautiful gardens, which reach a depth of some miles in places and extend in practically an unbroken expanse all the way up to Basra and in less prolific culture even as far as Gurna. These date gardens are beautiful things, beautiful for what they are now, and more beautiful still as a suggestion of what all Mesopotamia might be. They are also one of the most melancholy things in the world as reminders of what the past developed and the present has wasted.

The land has enormous resources for agricultural development. That whole vast district may be made into the garden spot of the earth. The soil is the best in the world, river silt hundreds of feet deep. It is as level as a parlor floor, with just enough pitch between the big rivers, and between the north and south, to make irrigation easy. All that is necessary is a perfected system of irrigation, and although the necessary investment would

5: Harrison D-4 (1912-1924) 1924 M1 Middle East
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312 185 be large, running up to hundreds of millions of dollars, it should bring excellent returns. The trouble hitherto has been the unstable character of the government and the consequent risk to which any such investment would be exposed. During the time of the spring high waters, a disaffected tribe might obtain control of some important dam and with one stick of dynamite destroy nearly the whole system. But with a stable government the project should be one of great promise. The water is at hand, three riverfuls of it, and as if to prove the practicability of the dream, we know that in the ages of antiquity these resources were utilized for this purpose and with the most splendid success. Whether there is actually water enough to transform every square mile of the country into a garden or whether the supply of available land will prove to be more than the water can care for, especially now since the area has so greatly increased, can only be told after the project is tried. Certainly there is water enough for hundreds of square miles, enough indeed to make Mesopotamia one of the richest countries of its size in the world. Already one new irrigated area has been developed by the Hindiya Barrage built by a British concern between 1911 and 1913 as the first step in the reconstruction of the ancient irrigation system. The erection of this great barrage on the Euphrates River was due to the Young Turks, the dam being the first unit in a comprehensive irrigation project for the entire country which had been drawn up for them by the noted engineer, Sir William Willcocks. It is only a beginning, but it has made the desert rejoice and blossom as the rose over many square miles of territory.

311 312 185

311 162 With the exception of the rich petroleum deposits which are said to exist throughout the Mosul district and

5: Harrison D-4 (1912-1924) 1924 M1 Middle East
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311 which may play a prominent part in the economic development of the country, Mesopotamia may be regarded as a purely agricultural land. From this standpoint it is best considered in two sections. There is the river-irrigated date-growing district to the south, with Basra as its center, and there is the district to the north inhabited by nomads, semi-nomads and river agriculturists, with its principal center in Baghdad and a second capital further north in Mosul.

312 The date gardeners along the river in the Basra territory resemble in many ways the cultivators that can be seen in any oasis town in Arabia. Their work is very similar. Irrigation systems must be constructed. Channels must be provided to carry the water to the roots of the date palms and to the squares of alfalfa and other crops. There is this difference, however, that the water flows of itself. Twice a day the tide of the ocean backs up the water of the great Arab River as far as Gurna, about a hundred miles from the sea. The extensive cultivation of dates stops at that point. The water can be shut out of a field if so desired, or the gates can be opened and as much allowed to enter as is needed. The supply is unlimited and can be had twice a day the year around. The soil is ideal. It is rich and hundreds of feet deep. In natural endowment Mesopotamia is a paradise for date gardeners.

511 As a matter of fact, however, that country is far from a paradise for date gardeners. The favorable conditions ought to make their work easier and their remuneration greater, but the facts are otherwise. Their condition is worse than that of the cultivators in Hasa. It is the story of the Bahrein pearl banks over again. The increased wealth of the Bahrein pearl banks has not bene-

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[Marsh Arabs]

243 Bombay was. "No," he said, "here we make our bread
262 from rice flour. When the wheat crop is a failure, as in the past year, we have almost nothing else."

312 These overflow districts,* which are marshes in the spring when the rivers overflow, dry down to hard soil later in the year. To keep the water high for a few weeks longer than it would naturally remain so, temporary dams are constructed across some of the smaller streams, leaving an opening to allow boats to pass and water to run through. These dams persist in the face [342] of a strong current in a way that is surprising. Mud, tree branches, mats, soil and the like seem to be the only building material, for there is no stone within hundreds of [476] miles. The dams require a large amount of labor, and of course are coöperative enterprises. Possibly because of this necessity for coöperative effort, the Marsh Arab communities appear to have developed a good degree of community spirit.

361 Like their race everywhere, these Marsh Arabs do not live in isolated individual houses in the midst of their fields but collect in larger or smaller towns, some of them of considerable size. These towns are located usually in the fork of a river, or where several streams come together. In Lower Mesopotamia there are many small channels that carry water either out of the main
501 river or into it. The Marsh Arabs get about in picturesque, high-prowed, black river boats, black because they are covered with a thick coat of native bitumen which wells from the ground in one or two places in Mesopo- [135] tamia and is an indication, so the engineers tell us, that petroleum is to be found in that country. These river boats, which are the one means of transportation, are built somewhat on the lines of a canoe and take consid-

* [along the last 100 miles of the Arab river from Gurna to the Gulf -- Analyst]

5: Harrison D-4 (1912-1924) 1924 M1 Middle East
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try rather than fostering the development of something indigenous and natural. Under such a system the enforcement of law may become of necessity very mechanical, as when an Indian Sepoy nearly knocks down an inoffensive Arab pedestrian by a blow with his fist for no greater crime than walking on the wrong side of the road to avoid a mud puddle. In the courts, too, a crowd of lawyers and an abundance of red tape, with venal underlings, may serve to make the paths of justice tortuous and uncertain in spite of the best intentions on the part of the presiding judge.

Nevertheless, even under such handicaps as those we have indicated, there is no questioning the very great material progress that is to be seen in Mesopotamia. Even before the war one of Baghdad's streets was paved, and since the British have taken over the administration of the kingdom, all sorts of improvements have been introduced. The railroad system of the country now extends 360 miles from Basra to Baghdad and from there on nearly to Mosul. There are several subsidiary lines, the total amounting to over 1000 miles. By far the greater part of this mileage was constructed by the British for war purposes. Under British rule, also, the Hindiya Barrage and other less important irrigation works have been kept in order and improved and extensive harbor improvements at Basra undertaken.

British sanitary and health officers have been appointed for Mesopotamia and no praise is too high for their largely unappreciated but nevertheless unselfish and extremely efficient labors in that country. The hospital work that has been undertaken in Basra, Baghdad and Amara, the inspection of eating houses, and the maintaining of sanitary conditions have been excellently done.

15: Tannous N.G-5 (no date) 1951 M1 Middle East M1
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equipment, and the livestock. In reality the cultivator's share amounts to less than that, for he has to make certain contributions to local functionaries and to the agent of the landlord.

There is also clear evidence that unless the system is checked effectively at its roots, it will continue to perpetuate itself. Witness what has happened during the last 50 years or so. Irrigation has been expanded materially, mainly through pump installations, and total agricultural output has been increased tremendously; but the peasant has remained landless and impoverished. In general, he does not possess the ability or initiative to prove his legal claim to the newly developed land. In many cases, even when his right of ownership is recognized, the cultivator is not able financially to maintain the costly pump installation. He is obliged to work on a share basis with one who is able to supply the necessary capital and equipment, be he the chief or the merchant. Gradually, these become the owners of the land, and the original occupant becomes permanently a landless sharecropper. Through this process the virile and integrated tribal community of Iraq is being transformed into a demoralized agricultural settlement, under the control of an absentee landowner chief.

Syria affords another illustration of the magnitude of the problem. We witness here practically identical conditions of absentee ownership, sharecropping, and low levels of living among the peasants. The manner in which this system threatens the future of agricultural development in Syria is clearly indicated by recent happenings in the Jezira area. This has tremendous possibilities for irrigation and for dry farming. It is sparsely populated, and until recently has been utilized mainly for grazing by nomadic and semi-nomadic tribes. During the last few years cultivation has been expanded rapidly in the area. Modern machinery has been put on the land in large numbers, and bumper grain crops have been harvested.

On the surface, this appears to be the beginning of sound development. Upon closer examination, however, we encounter a different reality. The tractor has been put on that fertile soil mostly by speculators and absentee owners. Concern about the ultimate exhaustion of this great national resource is not upper-

15: Tannous N.G-5 (no date) 1951 M1 Middle East M1
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M 471 427 E 471 427 distributed reclaimed state domain among the peasants. During the past few years the Ministry of Social Affairs, under energetic and progressive leadership, has been increasingly and effectively sponsoring the cause of the peasant. Among other things, it has proposed draft laws aimed at land reform and at improved tenancy terms. In July 1950, the Egyptian Parliament passed one of these bills, stipulating that estate owners should provide tenants with certain housing and health facilities, and with other services. During the last two years certain deputies have proposed two definite draft laws for land reform in Parliament. Similar proposals have been made by other responsible leaders. All of them aim straight at the heart of the problem — stipulating the distribution of state domain among peasants, the restriction of the size of holdings within minimum and maximum limits, the extension of credit to the new small owner, the protection of peasant property, the improvement of tenancy terms, etc.

I 423 M 423 A similar consciousness of the magnitude of the problem and the grave consequences it might entail has arisen in Iraq. As far back as 1932 a comprehensive program of land survey and registration was initiated and has been in operation since. At the end of 1947 about 20 million acres (close to 20 percent of the total area of the country) were surveyed and classified. This program constitutes a basic move in the right direction, as it results in clearing the great confusion over title claims.

I 423 312 166 425 M 423 425 166 In 1945 the Iraqi Parliament passed a bill (Law No. 23) authorizing the Government to distribute state domain among landless peasants or tribesmen on the basis of small private ownership. It was a small beginning as the application of the law was restricted to one specific area, the Dujaylah lands, in the Kut Liwa south of Baghdad. Some 180,000 acres were put under irrigation and divided into plots of about 60 acres each for distribution to farming families. After a probationary period of 10 years under government supervision, the farmer can acquire complete ownership of the land. At the beginning of 1947 about 400 cultivators were settled on the project land. Possibly an equal number has been settled since that time. In 1946 another project, the Hawijah Settlement Scheme, was finished. It involved the distribution of some 200,000 acres of irrigated state land among members of the 'Ubayd tribe.

25: Warriner S-5 (no date) 1948 M1 Middle East
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Chapter VII

IRAQ

LAND AND POPULATION

THE peculiar feature of agriculture in Iraq is that in the greater part of the country extensive farming is practised on irrigated land. Elsewhere in the Middle East irrigation is always accompanied by a great intensification of production, but in Iraq extensive and shifting cultivation is practised even on irrigated land, and both land and water are wasted.

The productive area of the country falls into two halves—the rainfall zone in the north, and the irrigation zone of the south, on the alluvial plain between the two rivers.

In the irrigation zone, there is no controlled system of irrigation, as in Egypt. Each river has a modern barrage, the Tigris at Kut, and the Euphrates at Hindiya, but both are situated low down towards the delta, and command a comparatively small area of cultivation. Apart from the areas served by the barrages, the main system of irrigation is by flow, that is, by basin irrigation.

There are two flood periods, December to March, due to winter rains, and March till May, when the snow melts in the higher reaches of the rivers, and there are therefore two crop seasons. The danger of flood is always present, because the level of the rivers in many parts is a few feet higher than the level of the plain. Some progress has been made in recent years in flood control, as for instance the Habbaniya escape, but there is great need for a reservoir in one of the upper tributaries of the Tigris to prevent flooding in the spring and to release extra water in the dry season.

In recent years there has been a rapid extension of cultivation as population has increased. In 1918, the total cropped area in the irrigation zone was only 936,500 acres, and in 1943 it had increased to 4,241,718 acres.

The classification of land in Iraq presents difficulties, because not all the cultivable area is cultivated and not all the cultivated area is cropped.

The main divisions in 1943 were as follows:

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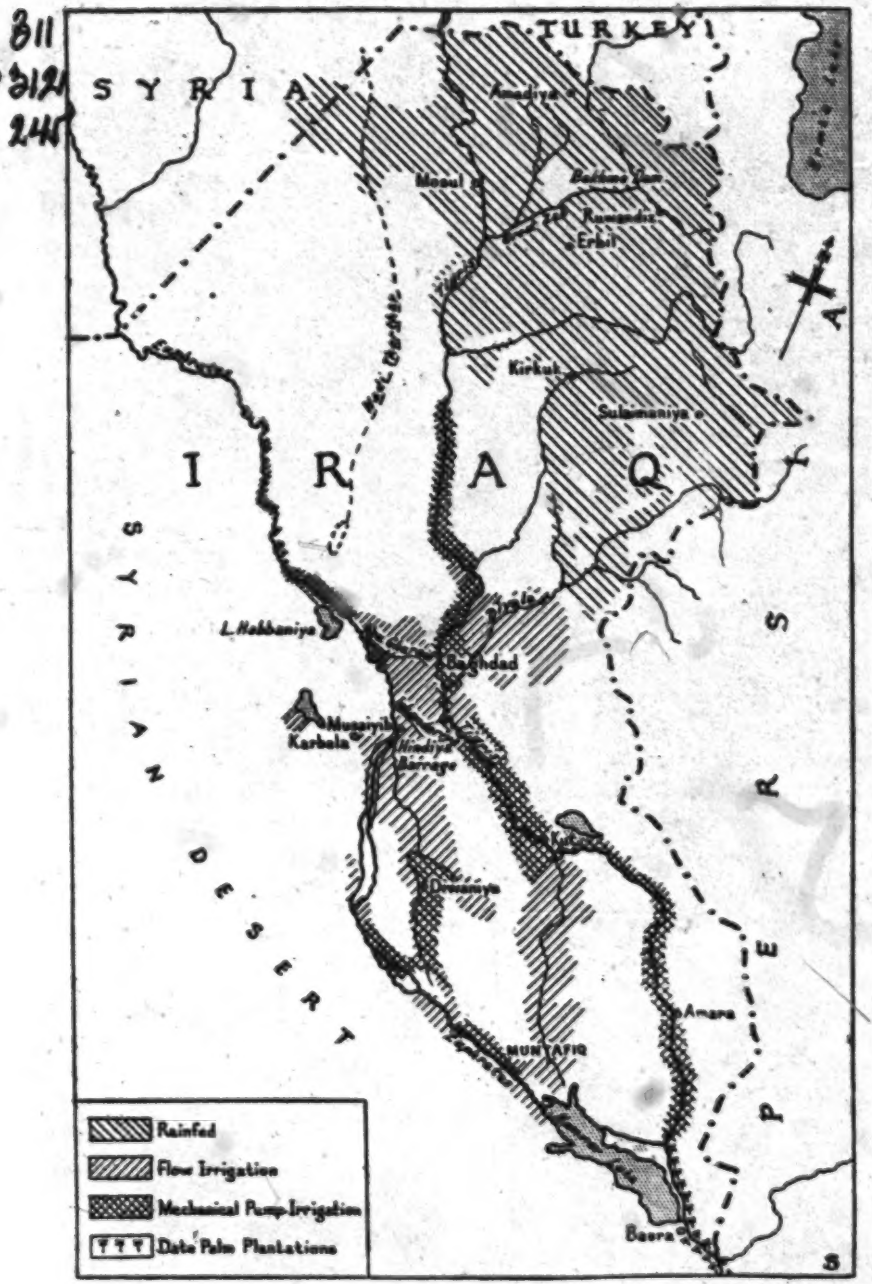

IRAQ: TYPES OF CULTIVATION

LAND AND POPULATION

LAND UTILIZATION IN IRAQ

	Square Kilometres	Acres
311 (a) *Total Area*	453,500	112,060,000
(b) *Rainfall Zone*		
312 1. Approximate gross area of cultivated and cultivable lands	41,000	10,131,000
2. Approximate *shitwi* (winter) and *saifi* (summer) areas at present cultivated annually	6,000	1,483,000
(c) *Irrigation Zone*		
1. Approximate gross area of cultivated and cultivable lands	80,000	19,770,000
2. (a) Area of *shitwi* (winter) cultivation capable of annual irrigation by river supplies	16,000	3,900,000
(b) Area of *saifi* (summer) cultivation capable of annual irrigation by river supplies	4,300	1,054,000
3. *Shitwi* (winter) areas at present irrigated annually	12,100	2,947,000[1]
4. *Saifi* (summer) areas at present irrigated annually	4,000	1,001,000[2]
5. *Shitwi* and *saifi* areas at present cultivated annually (total of 3 and 4)	16,100	3,948,000
6. Garden areas at present irrigated annually	1,200	309,000
7. Total area cultivated (5 and 6)	17,300	4,257,000

Source: Ahmed Sousa, *Iraq Irrigation Handbook*, Part I: The Euphrates (Baghdad, Directorate General of Irrigation, 1944), pp. 11–12.

Thus the total cultivated and cultivable and cropped areas are:

	Acres
Rainfall Zone	
Cultivated and Cultivable	10,131,000
Cropped	1,483,000
Irrigation Zone	
Cultivated and Cultivable	19,770,000
Cropped	4,257,000
Total Cultivable Land	29,901,000
Total Cropped Land	5,740,000

The cropped area in the irrigation zone is divided between:

Winter crops	2,947,000
Summer crops	1,001,000
Garden areas (i.e., dates, etc.)	309,000
TOTAL	4,257,000

311 The cropped area amounts to only one-fifth of the cultivable area, and this needs explanation since it suggests that great increases in cultivation are possible. Within the area cultivated

[1] By lift from pump installations approximately 1,591,980 acres; by flow from perennial canals approximately 1,355,620 acres.

[2] By lift from pump installations approximately 560,560 acres; by flow (rice and other summer crops) approximately 440,440 acres.

25: Warriner S-5 (no date) 1948 MI Middle East
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311 at any one time, a large proportion of the land is left fallow, as water supplies are insufficient to irrigate more. The cultivated land is approximately twice the cropped area, but under present conditions it would not be possible to crop the whole area owing to shortage of water. If water could be stored for the summer period, a crop could be sown during the summer in the irrigation zone. When the Bekhme dam is completed, the summer supplies of water will be so large that the area under summer crops could be greatly increased.

Not only is much land left fallow within the area which is being cultivated at any one time, but the area of cultivation shifts within the irrigation zone at intervals of several years, because after a period of cultivation the soil becomes saline. This results from the lack of drainage. Only in the areas where there is natural drainage from the Euphrates to the Tigris near Baghdad, or further south, where the Tigris drains into the Euphrates, is there no danger of salinity. When the soil gets saline, the landlord abandons it and transfers cultivation to new ground, and new canals are dug. This is of course a wasteful system, and can only continue as long as there are ample reserves of land. Thus an increase in the area cultivated depends on (1) a general irrigation system, (2) a general drainage system.

311 The question of how far it will be possible to extend the area under cultivation depends on how great an increase in total water
● 312 supply is practicable. It is water, not land, which is lacking in Iraq. Varying estimates are available; Sir William Willcocks considered that the amount of land which could be put under winter cultivation in the irrigation zone with the existing average supplies of Iraq's rivers would be 7,410,000 acres or two and a half times the present winter cropped area.[1] Ahmed Sousa, in the estimates given in *Iraq Irrigation Handbook*, puts the total area which could be put under winter crops with the existing water supplies at 3,900,000 acres,[2] an increase of one million acres on the present area cropped.

On this estimate the maximum addition to the area under winter cultivation may be about one million acres; and possibly half a million acres could be added to the summer cropped area

[1] *Irrigation of Mesopotamia*, 2nd edition (London, Spon Ltd, 1917), p. 9.
[2] p. 3.

25: Warriner S-5 (no date 1948 M1 Middle East
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which now amounts to one million acres. More might be added by water storage schemes. At present several large new schemes are under consideration. These involve flood control by the construction of the Bekhme dam on the Great Zab, and an extension of the Habbaniya reservoir. In addition to the Bekhme dam a scheme for flood irrigation in the Wadi Tharthar is being considered. A survey commission is now preparing a report on these developments, but so far no estimates have been made of the area of land likely to be brought into cultivation.

At present there is no shortage of labour. The population is small in relation to the area cropped, but it is growing rapidly. In 1931, according to Dowson, the total population was 2,824,000, of which 2,246,000 were estimated to be rural, including 895,000 settled population and 1,351,000 still living in tribal conditions.[1] Estimates for 1943 put the total population at 4,500,000, of which the rural population was 3,500,000. Some regions, Basra, Karbala, Dulaim, and Muntafiq are densely settled, while others, chiefly in the north, Mosul, Erbil, Kirkuk, are settled very sparsely. The area of cropped land per head is 2 acres, and the area of cultivated land perhaps as much as 4 acres.

LAND TENURE

It is clear that Iraq has greater prospects of agricultural expansion than any other Middle East country. But to the development of these potentialities the greatest obstacle is land tenure. Sir Ernest Dowson, in his classical report on the subject, says: 'The injurious effect of the existing welter of uncertainty and dispute upon both the agricultural prosperity of the country and public order, can hardly be exaggerated. Every one directly or indirectly concerned with agriculture in el 'Iraq must know many individual cases in which the development and use of the land has been gravely obstructed by the widespread insecurity and confusion of rights. Indeed the most diligent inquiry would be unlikely to reveal anywhere any appreciable number of holdings, large or small, held in undisputed possession and free from hampering and conflicting claims. It needs no great effort of the imagination to appreciate the blighting effect of these unhappy conditions prevailing throughout the country, upon the

[1] Sir Ernest Dowson, *An Inquiry into Land Tenure and Related Questions* (Letchworth Garden City Press for the Iraqi Government, 1932), p. 12.

tribal organization there was no clear definition of individual rights of ownership to the collectively-owned land. It was a system which could exist as long as no one thought about it; as long, that is, as the tribe was accepted as the unit of political life, and as long as no individual claims were likely to be made. It is for this reason that it is impossible, once the tribal system has ceased to be the political unit, to settle land on a tribal basis; and yet to settle land on the basis of the supposed individual claims creates grave injustice, because in practice it means that too much land is allotted to the sheikhs and that the cultivators are reduced to the position of tenants or labourers.

Since the early years of the twentieth century the tribal system has been breaking up, and the economic development of the country in the twenty years between the wars has hastened its disintegration. When water transport came to the Persian Gulf towards the end of the nineteenth century, export markets opened for Iraq grain; the subsistence economy broke down and production for export began. Exports of grain increased from 65,000 tons in the early eighteen-nineties to 120,000 tons in 1909–13, and to 380,000 tons in 1934–9. The profitability of export has given the tribal chiefs a motive for acquiring land as their personal property.

The tendency to acquire land for the sake of money income was much strengthened, in the twenty years between the two wars, by the rapid extension of pump irrigation and the accompanying increase in the cultivated area. Pump installations have increased from 143 in 1921 to 3,000 in 1944, and provide water for some 2½ million acres of land, or over half the cultivated land in the irrigated zone. The installation of a pumping system is comparatively cheap, costing some £2,000 before the recent war, but it is far beyond the means of the peasants, so that pumps have been installed by sheikhs, or more frequently by city notables, who make contracts to supply them to peasants at extortionate rates of interest, and so gradually acquire the land in payment of debt. In many cases the sub-chiefs, or sirkals, have become pump owners.

Thus in the regions of pump irrigation the tribal system has entirely ceased to function. The land is mainly the property of the pump owners, with the cultivators taking a meagre share of the crop, varying from one-seventh to one-fourteenth or one-

25: Warriner S-5 no date 1948 MI Middle East
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twenty-first part of the total. The position of the share-tenant in Iraq is much worse than that of his counterpart in Syria.

In the districts of flood irrigation the tribal system has disintegrated, but its superstructure, the sheikhs and sirkals, remains. Most of the political functions of the tribe have now been transferred to the State, and the only economic function now performed by the tribal authorities is the control of irrigation, digging of canals, and repairing of breaches, which is done by the cultivators under the direction of the sirkal who has become a kind of farm bailiff acting for the sheikh. Under this system the sheikh and sirkal take together up to 80 per cent of the crop, leaving the cultivator some 20–30 per cent.

This exploitation is possible because the sheikhs have succeeded in establishing, mainly during the last fifteen years, their title to absolute ownership of the tribal land by means of land settlement. Because in Ottoman times the cultivators had no legal title to the land which they occupied, the landlords were able, during the period of the mandate, to use their political power to secure legal title to land which was by custom and tradition the property of the tribe. In much the same way the English landlords of the eighteenth and nineteenth centuries enclosed land as their property which was traditionally common property, and ousted small holders whose title was based only on custom. As in nineteenth century England, the process is being hastened by mechanization, which gives the big landowners an advantage as against the small cultivator, and by inflation, which gives them the impetus to invest. The big landowners of Iraq are a comparatively recent creation, and it is the economic and legal changes of the past twenty years which have established their position.

Northern Iraq. In northern Iraq there is a different type of land tenure and fewer large landowners. South of Mosul, in the fertile Tigris Valley, where pumps have been installed, there is a tribal system resembling that of the south, and the land is owned mainly by tribal sheikhs and notables. West of Mosul, on the rolling uplands with poor rainfall, the land is also held on a tribal system. In this region in recent years there has been a rapid introduction of machinery; and the sheikhs are extending their power to acquire land. In future bigger imports of machinery will probably cause them to extend their influence

29:Dunn S-4 (1952)1952 Ml Middle East
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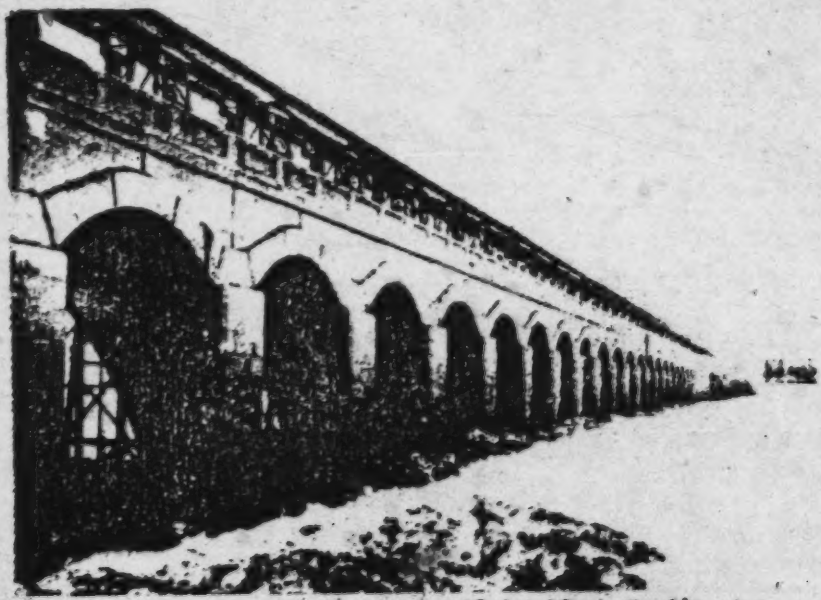
initiative and financial assistance of the government.[36]

The government has been advised to encourage development of light industries: Cotton textiles, cottonseed oil crushing mills, jute mills, bone fertilizer plants, automobile tire factories, small steel mills, central machine shops, concrete block plants, possibly a paper mill, a chemical factory for making inorganic fertilizer, and possibly salt refineries.

The Mission strongly urged the government not to attempt to own or operate these new factories itself, but to encourage private capital to do so.[37] This recommendation has been followed in the main. The Industrial Bank, created with funds derived from the oil royalties, has been financing private industry in a number of fields, particularly cotton textiles and cottonseed oil crushing and refining. The outstanding exception is the new petroleum refinery being built by the government.

OIL

Oil reserves in Iraq are thought to be tremendous—at least a third of the total Middle Eastern reserves, which are reckoned at 50 billion barrels, or



—Photo Courtesy of Technical Cooperation Administration

Capacity of the Kut Barrage on the Tigris River in Iraq is almost a quarter of a million cubic feet of water per second, which makes it the largest diversion dam of its kind in the world. The dam was built by British contractors for the Iraq Government in 1939. With oil revenues now pouring into the treasury Iraq plans to build several more large-scale irrigation facilities for storage and diversion. New projects are already in progress in the upper reaches of the Tigris River system.

[36] *Ibid.*, p. 25.
[37] *Ibid.*, pp. 26-27.

29:Dunn S-4 (1952)1952 MI Middle East
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COTTON IN IRAQ

The problems of land tenure are generally cited as being a restriction to agricultural development. One United Nations' study states the absence of settlement title is undoubtedly a major obstacle to expansion of cultivation of dry land and intensification of agriculture in irrigated or irrigable zones.[40] The same report also points out that the lack of adequate legislation on water rights is another serious defect.[41]

RESETTLEMENT

Sizable areas are being settled by the state under the provisions of a law passed in 1951 which distributes about 67 acres per family to landless people, agricultural school graduates, former civil service employees, pensioners, and the unemployed. The farming program on these projects is supervised rigorously. On the 75,000-acre Dujaila Project on the Tigris River the prescribed planting program is as follows: 20 per cent in wheat, 15 per cent in barley, 5 per cent in fruit, 4 per cent in cotton and flax, 3 per cent in sesame, and 3 per cent in vegetables. Another 5 per cent will be devoted to housing, and the remaining 45 per cent must lie in fallow because of a water shortage.[42]

The Mission report criticized these land settlement schemes on several bases. The land is given to the farmers, the title being transferred after 10 years of successful operation. The Mission believes the land should be sold. The Mission also criticizes the allocation of land to people who have had no farming experience and who have not necessarily shown themselves to be suited by temperament for farming, and it expresses doubt that the program actually has improved the land or the farmer. The economic report stated: "The improved economic position of the cultivators in the new Dujaila scheme is almost wholly due to the fact that the farmer there has a larger plot of land and does not need to surrender a share of his output to his landlord."[43]

There are half a dozen other projects, involving 250,000 acres, in various stages of promotion which the Point Four Mission is being urged to assist in planning and supervising.

IRRIGATION

At present irrigation water is provided by the Kut and Hilla Barrages on the upper Tigris River, several smaller ones on the lower reaches, and the Hindiya Barrage on the Euphrates River. The water is carried by pumps and canals. About 2 million acres are irrigated by pumps and another 4 to 5 million acres by gravity flow.

Estimates indicated cultivatable land can be expanded almost three times if water is available. Yet, under current conditions, the supply of water does not permit even the effective irrigation of the area already in use. Projects for the storage of excess water which pours down the Tigris and Euphrates Rivers during the spring flood season are clearly essential. The government already has initiated work on the Habbaniya Lake storage system for the Euphrates River and has let the contract for the first stage of the Wadi Tharthar flood control project on the Tigris River. The Development Board is undertaking also construction of three dams on the upper tributaries of the

40 *Land Reform*, United Nations, 1951, p. 27.

41 *Ibid.*, p. 27.

42 *Final Report of the United Nations Economic Survey Mission for the Middle East*, United Nations, December, 1949, p. 31.

43 Boardman, Frances, "Iraq Moves Toward Land Reform," *Foreign Agriculture*, U. S. Department of Agriculture, September, 1951.

1 - [Text continues on p. 97--Analyst]

29:Dunn S-4 (1952)1952 MI Middle East
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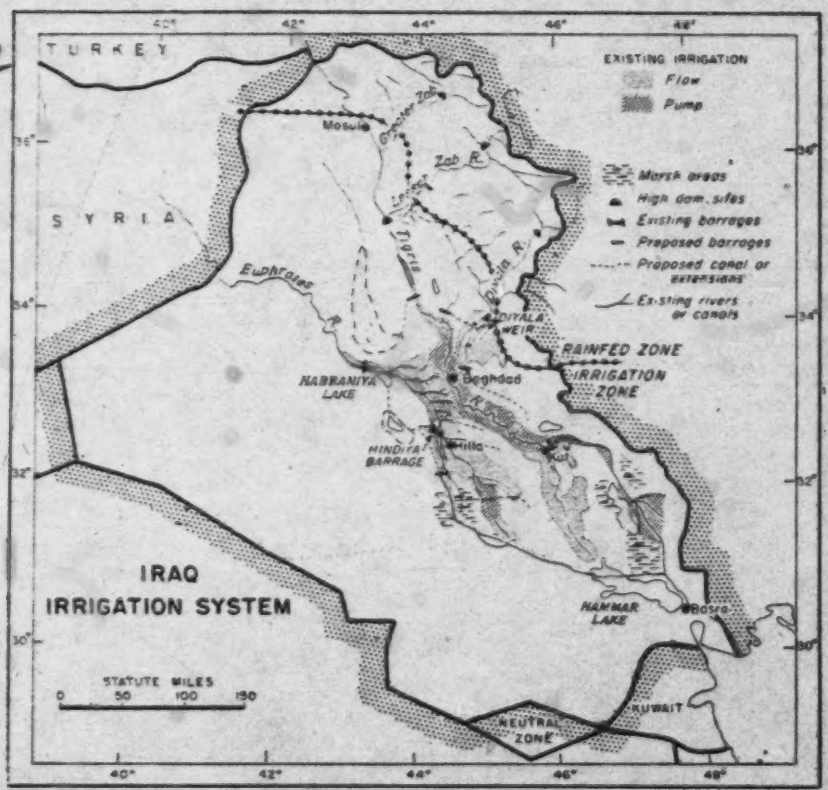
COTTON IN THE MIDDLE EAST

Table 32

IRAQ: Area Under Cultivation by Crops as Per Cent of Cultivated Area
1948

Crop	Per Cent of Total
	Per Cent
Rice	12.3
Sesame	2.5
Maize	1.4
Green Gram	1.0
Millet	.9
Wheat	40.2
Barley	40.6
Linseed	.1
Lentils	.4
Chickling	.3
Cotton	.3
Total	100.0
Total Acres under Cultivation	5,877,494

SOURCE: Office of Foreign Agricultural Relations, United States Department of Agriculture.



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COTTON IN IRAQ

Tigris, and a large reservoir at Bekhme in the mountains on the Great Zab. The Mission endorsed these projects and recommended others to compensate for diversion and to balance the systems.

The Iraq Irrigation Development Commission believes that the area under irrigation can be increased to 12 million acres by the installation of additional storage facilities, by drainage, rehabilitation, and by new supplies of water.[44]

It is agreed generally that the rain-fed zones in the north must continue to depend primarily on rainfall. Although no accurate estimates are available, the total area which might be available for cultivation in this area is thought to be substantial.

Along with irrigation, an important means of improving productivity is drainage. This would have an immediate effect; other proposals depend on the necessarily slow process of persuading farmers to abandon age-old methods of cultivation.

As much as 20 to 30 per cent of the cultivated land is said to be abandoned because of salt accumulation. On a large part of the remaining land, yields have declined as much as 50 per cent. Drainage—almost totally neglected—the report concluded, should therefore be prosecuted with utmost vigor.[45]

MECHANIZATION

Because of the cost, the Mission predicted that mechanization would proceed slowly. This conclusion was reached in the face of experience which shows that tractor ploughing may increase yields 20 to 50 per cent, largely through more effective destruction of weeds and better preparation of the soil.[46] No doubt mechanization will become increasingly important as additional land is placed under cultivation and labor becomes scarce.

About 750 tractors and 320 combines are in the country at the present time. A government agency owns 75 of the combines and 81 tractors and plans to import an additional 2,500 tractors and 550 combines with auxiliary equipment.[47] About 50 per cent of the machinery will be retained at government-owned tractor stations and rented or let out under contract.[48] The rest will be sold on easy terms to the farmers.

The International Bank approved a modified version of this machinery program but suggested that rental charges be increased to make the project self-sustaining, and adequate repair shops and demonstration and training programs were recommended.

SOIL BUILDING

It is obvious that the fertility of the soil needs to be replenished.

Cultivation of soil-building and forage crops is said to be virtually unknown. Attention needs to be given to the production of legumes. Commercial fertilization must be studied and, if possible, plants should be built to produce inorganic and organic materials. Soil analyses also are generally needed.

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44 *Economic Development of Iraq*, op. cit., p. 16.
45 *Ibid.*, p. 17.
46 *Ibid.*, p. 18.
47 *Ibid.*, p. 19.
48 *Final Report of the United Nations Economic Survey*, op. cit., p. 33.

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Iraq MH

242 being conducted this year with about nine different insecticides, but a more thorough program is needed.

The FAO is supplying a specialized cotton entomologist, and the Point Four Mission is supplying a general entomologist to help develop an effective program.

[654] The country has a law requiring that all cotton stalks must be destroyed, the debris burned, and the land ploughed by the first of January. In fact, the farmer is not given permission to plant cotton again unless he has complied with these regulations. Seed sterilization also is required. But the Director General himself admits the program has been ineffective. There are many host plants on which cotton insects can live, and the people do not understand the law or are not in a position to comply, especially where they are in the habit of saving the stalks for fuel.

One of the real difficulties is the growth habits of the present Acala varieties which are said to set 80 per cent of their bolls on what is called the second flush, after the end of August, when the insect population is highest. Efforts are being directed toward development of varieties that have a shorter maturing period, and early results with Coker Wilt have been encouraging.

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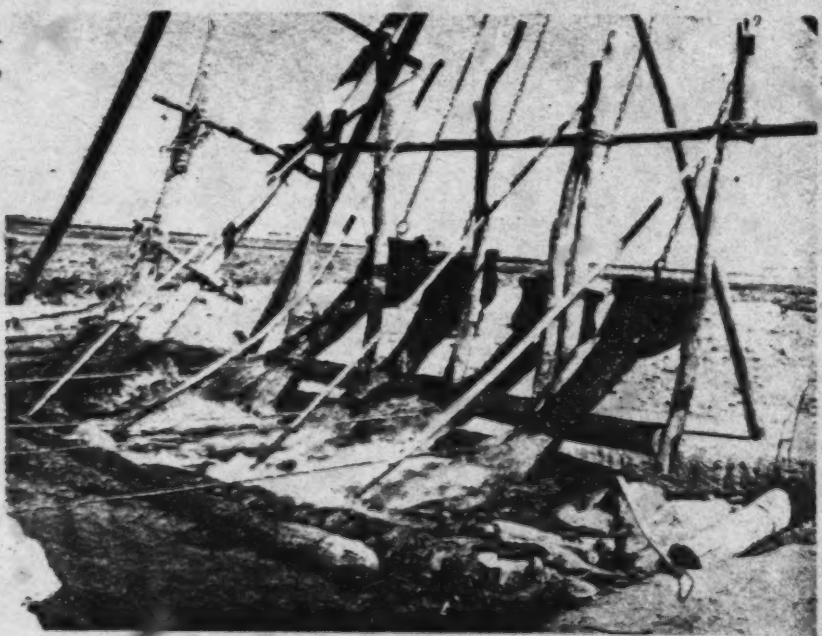

—*Photo Courtesy of Technical Cooperation Administration*

This irrigation system of a farm in southern Iraq dates back to Biblical times. Mules walk down an inclined track beside the well pulling the goatskin water scoops. The scoops, hauled to ground level by the mules, spill their contents into the irrigation ditch. Through the Point Four Program the United States is cooperating with the Government of Iraq in its extensive projects to modernize and improve irrigation and increase crop output.

IRAN MA1
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lators fostered irrigation practices and the construction and repair of conduits and established, under the law of 9/VI/1309 as amended by those of 21/III/1312, 13/VI/1313 and 15/XII/1316, the Agricultural Bank which is empowered to open credit for the implementation of such works. N 312 423 654

On the other hand, the government intervened and obtained, under the laws of 6/VII/1309, 15/XII/1310 and 25/VIII/1316, credit for the irrigation of abandoned, formerly fertile areas and for the subsequent sale of these improved lands to private individuals on condition that they be rationally cultivated.

The Independent Irrigation Institute

The above institute, established under the law of 20 May 1943, was set up with a view toward developing and improving irrigation practices in Iran. It has been placed under the Ministry of Agriculture for a period of ten years (Article 4), and annual credit has been allocated to it by the government (Article 2). N 647 312

This independent Institute shall supervise and carry out all irrigation and drainage projects (Article 11). It shall provide technical assistance to private individuals who wish to carry out irrigation works at their own expense and shall design plans for these works (Article 5).

It shall have the right to collect dues for the allocation of water (Article 6). It shall form societies for the implementation of irrigation works in which private owners may participate. N [651]

The institute is authorized to set up the necessary administrative offices to ensure the distribution of water and to guarantee the maintenance of dams, reservoirs, public canals, kanâts, etc. It may also compel the owners of kanâts to repair, clean or destroy them and eventually to carry out these operations at their own expense, regaining the amount involved either directly or on crops. 647 312 656

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Since the gradual occupation of Iraq by the British Forces Q 671 312

671 312 (1914-1919) 1/ and its separation from the Ottoman Empire (Treaty of Lausanne, 1923) the Mejelle or Ottoman Civil Code has remained the basis for Iraq's water laws.

Aside from this Code, other laws relating to water use have been promulgated and these legislative measures were supplemented from time to time by Regulations and Instructions. The laws, Regulations and Instructions now in force on water use in Iraq are enumerated below:

1. The Mejelle Civil Code, compiled from 1869 to 1876.

2. Law No. 52 of 4 October 1923 which has been amended by various other laws and amplified by Regulations and Instructions.

   a. Circular No. 508 dated 26 January 1924 giving instructions for the better execution of the law.

   b. Royal Iradah (Decree) No. 118 dated 31 July 1926 which makes this law applicable in ten out of fourteen liwas (administrative districts).

   c. Royal Iradah (Decree) No. 171 dated 20 June 1931 which makes the law valid throughout Iraq.

   d. Amendment Law of 22 January 1925.

   e. Amendment Law No. 39 of 24 April 1927 defining "irrigation works of public importance" to be so declared by special Regulation (see next sub-para. "f") and (ii) substituting with amplification Article 6 of the Law in connection with responsibilities for the repairs and maintenance of irrigation works.

   f. Regulation No. 56 of 9 October 1941, detailing the various terms of "irrigation works of public importance."

1/Proclamations issued from time to time by the General Officer Commanding in Chief of the Army of Occupation had legal effect on those areas gradually occupied. The validity of these Proclamations were subsequently recognised by the Constitution

5. Amendment Law No. 1 of 26 February 1945 amending again Article 14 of the 1923 Law, and adding a provision for silt clearance by mechanical means under some conditions. 671 312

3. The Forcible Assistance Law No. 27 of 31 March 1923, as subsequently amended by Law 24 of 30 March 1936.

4. Law for Rice Cultivation No. 23 of 31 March 1932, amended by the Law Amending Rice Cultivation Law No. 53 of 15 May 1940 prescribing that Regulation shall determine the areas in which rice cultivation is to be prohibited or restricted for health reasons, economy in the use of water or for the conservation of the soil.

5. Liwa Administrative Law No.16 of 15 February 1946 which, in Article 24, paragraph 9, prescribes among the various functions of the mutassarrif (prefect or governor) in his Liwa (one of the 14 administrative districts of Iraq) that he shall "give assistance and facilities to cultivators and ensure distribution of water to their cultivations." Paragraph 1 (b) of Article 63, places within the duties of the Liwa administration "the improvement and drying of pools and swamps." Paragraph 8 of Article 65 includes among the expenditures of the Liwa administration the "cost of construction and maintenance of irrigation works belonging to it (the Liwa), except those undertaken by the State."

6. Law Governing the Rights and Duties of Cultivators No. 28 of 1 July 1933, makes the "farm owner" responsible for aligning watercourses (Art. 3 d); fixing time for watering and manner of distributing the waters among the various sections of the land (Art. 3.g).

7. Land Settlement Law No. 29 of 11 April 1938, as subsequently amended prescribes vide Article 3, paragraph 2, that settlement shall include the "confirmation of rights appurtenant to land such as.....of waterway, of drainage and of drinking and also....." and that such "rights shall be registered (Article 13, paragraph "a") in the names of such interested persons."

8. Law for the Development and Usufruct of State Lands No. 43 in force as from 17.9.1951 prescribes that the Committee set up for the Management of State Lands dis-

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tributed into small plots for purpose of development shall be entrusted with the distribution of water within the project's areas (Article 11, para. 3) and water distribution shall be confined to the lands of the project (Article 11, para. 1).

1) The Use of Water for Irrigation Purposes

Notification No. 226 of the Minister of Communications and Works dated 9 June 1927, issued under the Irrigation Law of 1923, declares all rivers (anhar) and waterways (majari) in Iraq to be "Irrigation Works." This term covers irrigation and flood protection works as well as areas, occupied by or required for the construction or maintenance of such works. The right of undertaking irrigation works on privately owned lands is granted (Art. 3) to the Government, provided the land so required for the works is expropriated according to Law, once the proposed works have been declared to be of public utility. A private owner wishing to carry out works on or through another person's property shall obtain a certificate from the Executive Irrigation Engineer, stating the necessity of such works together with their extent and probable effect on neighboring lands. The applicant remains responsible for the acquisition, lease or arrangement with the interposed owners (Art. 4).

Requests from particulars for constructing any irrigation works are submitted to the mutassarrif of the Liwa concerned. If such requests are not rejected for administrative reasons, they are transmitted to the Executive Irrigation Engineer who may reject them on technical ground or otherwise issue the necessary permit on Irrigation Form No. 44, embodying instructions constituting the specifications of the work for which approval has been granted. The Law does not confer "water rights," but when a permit is issued and implies use of water, it is henceforth recognised that the land to be brought under cultivation shall enjoy the use of water under conditions similar to others within the same district.

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All irrigation works of public importance shall be constructed, repaired and maintained by and remain under the control and supervision of the Irrigation Department, even when such works have been declared to have ceased to be of public importance (Art. 6). The Executive Irrigation Engineer may require the person responsible with the maintenance of waterpourses (channels not maintained by the Government, Art. 2, para. 4),

to carry out the necessary repair work and in the event of failure, the said Engineer may execute such work at the expense of the defaulter. If damage has been caused to structures and the offender is not found then the owners of the lands depending on the watercourse shall be held jointly responsible (Article 7). A "Notice of Repair or Removal" on Irrigation Form No. 45, is used for the repair, removal or reconstruction of works as defined under Articles 4, 7, and 11 of the Law. 312 647 654

The Irrigation Engineers shall determine the dimensions of canals and watercourses, the lands and areas which may be irrigated from such canals and watercourses (Article 5). The distribution of water is carried out by the Irrigation Department up to a point below the heads of the watercourses (Article 8). Interference with another person's water supply, or the opening of any outlet which has been closed by competent authority or the taking of water from a source other than that prescribed by the Executive Irrigation Engineer, are not permitted (Article 10).

Article 9 prescribes that the Executive Irrigation Engineer shall have the power to stop the water supply to any watercourse in the following cases:

a) for the purpose of executing irrigation works;

b) whenever the watercourse is not maintained in such repair as to prevent the wasteful escape of water;

c) to supply water in rotation;

d) whenever wastage or misuse of water takes place;

e) whenever notices issued or demands made have not been complied with regarding (i) maintenance and repair of works (Article 7); (ii) supply of able-bodied persons for undertaking either work or repairs to works for preventing loss of life or serious damage to property and land (Article 13) or repairs and maintenance of irrigation works (Article 14). This notice shall be called "Notice of Stoppage of Water."

Article 11 states that no person shall construct any building, canal or watercourse, erect any pump, water lift or water wheel, plant any crops within the boundaries of any irrigation area without the written approval of the Executive Engineer, who

312 may order the offender to remove the unauthorized structure with-
647 in 15 days of the date of notice served on Irrigation Form No.
654 45. Should he fail to comply with the instructions contained in the Notice, the work of removal may then be carried out by the Executive Engineer and cost recovered from the offender.

If the water supplied is used in an unauthorized manner or causes damage to the lands, and if the persons responsible cannot be discovered, the person or persons on whose land such water flowed shall be held responsible. Such person shall be liable to a fine not exceeding 20 rupees per mashara 1/ of inundated land.

2) Requisition of Labour

Article 13 provides for the recruiting at rates of pay to be fixed by the Executive Engineer in consultation with the Mutassarrif, of able-bodied persons whenever workers for the immediate execution of emergency or repair works for preventing loss of life or serious damage to land and property cannot be obtained in the ordinary manner. For the purpose of the repair and maintenance of irrigation works, the person who will benefit from their being in good condition and will lose if otherwise, may be called on to furnish the necessary labor (Article 14).

The Executive Engineer may call on the mutassarrif or qaimaqam (sub-prefect or sub-governor) to raise the necessary labor contingent. To this end, the mutassarrifs shall furnish the Director of Irrigation with two statements every year, before the tenth of August: the first statement (Irrigation Form No. 47) shall show the total number of able-bodied men of laboring class residing in the Liwa, for purpose of Article 13. The second statement (Irrigation Forms 48 and 48A) shall show the total labor residing in the Liwa available for work under Article 14, during three different periods, i.e.: September to December - January to April - May to August. The requisition of labor, urgent (Art. 13) or otherwise (Art. 14) is made on Irrigation Forms 49 and 50 respectively.

Any person who refuses or neglects to supply labor as provided for in the two above-mentioned articles of the Law, shall upon conviction be liable to a fine not exceeding Rs. 500 or to

1/ 20 rupees = ID. 1/500 = $6.00; mashara = 1/4 hectares = 0.618 acres

imprisonment not exceeding two months or to both, fine and imprisonment. 312 466

The Directorate-General of Irrigation may undertake the clearance of irrigation canals by machinery, and the persons benefiting from such work shall refund the costs so incurred. (Last para. of Art. 14, added by Amending Law of 1945).

3) Offences and Penalties under the Irrigation and Embankments Law 312 681

Articles 15 to 18 deal with offences and penalties, in addition to those already mentioned.

Article 15 prescribes the death penalty for whomsoever wilfully and maliciously damages or alters any irrigation work thereby causing injury to life or to property and with penal servitude for life, or a term not exceeding 15 years, if it does not.

Article 16 lists a series of offences punishable by imprisonment not exceeding two months or a fine not exceeding 500 rupees of to both imprisonment and fine. Among the offences stipulated herein are:

Damage, alteration and obstruction to any irrigation work, interference with the supply of water; fouling of water; destruction, tampering with, or alteration of land, level marks or water gauges; damages caused to canal or flood enbankments by grazing cattle; refusal or neglect to supply labor; neglect to prevent waste of water; obstruction to Government official from executing their duties; etc. Addition to or cancellation or alteration to the above list may be made by Regulation (Article 20).

Article 17 prescribes a fine not exceeding 30 rupees for persons failing to comply with a notice to execute repairs, within the time specified in such notice.

4) Miscellaneous Provisions

In any proceedings on offences mentioned in Articles 12 and 16 thereof, before a Magistrate, a report signed by an assistant engineer or by any senior official in the Irrigation Department may be accepted as evidence in court. The recovery of sums due 312 681 694

312 to the irrigation department, and the procedure to be followed
681 for their recovery though covered by Article 19 is now done
694 through the Mutasarrifs concerned in accordance with the Law for the Collection of Debts Due to the Government No. 43 of 23 April 1931 as amended by subsequent Laws.

5) Rice Cultivation

243 The Law for Rice Cultivation No. 23 of 31 March 1932, as
656 subsequently amended by Law 53 of 15 May 1940, prohibits or restricts in areas defined by Regulation issued from time to time, the cultivation of rice for health reasons, economy in the use of water or soil conservation (Article 1).

Rice cultivation could only be conducted under special license (Article 4), and areas in which rice cultivation is restricted shall be fixed by Regulation (Article 2).

Regulation No. 34 of 28 August 1944, defines the regions in which rice cultivation is prohibited and also fixes areas in masharas for regions where rice could be cultivated.

The Minister of Agriculture shall decide the manner in which areas for rice cultivation alloted to each Liwa are to be distributed, and the mutassarrif concerned shall issue a notice inviting those interested to apply for the necessary permits.

Requests must be submitted to the qaaimmaqam of the qadha in which the lands are situated, and the mutassarrif, to whom the requests are transferred shall issue the permits, with the requirements of the Irrigation Department. The minimum distance between rice fields and inhabited localities shall be three kilometres. The permits are non-transferable and are strictly limited to the persons and to the plot of land and irrigation works stated on them. The permit holder agrees to the rotation of water supplies determined by the Irrigation Department, and he accepts responsibility for all shortage of irrigation supply with consequent damage to crops.

6) Offences and Penalties under the Law for Rice Cultivation

243 It is forbidden for any person to exceed the area for rice
681 cultivation fixed in the permits, or to cultivate without permit in prohibited and restricted areas. Contravenors shall be fined

63:Simmons et al G-5 (1941-1951) 1954
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Iraq

131 interspersed by several large lakes and in the south by extensive stretches of marshland. In many areas the plain is lower than the rivers, and the riverain lands are flooded each spring when the waters are swollen by the rains and the melting snows from the mountains. The Tigris normally reaches flood level in March or April; the Euphrates, a few weeks later. Both rivers are [312] tapped by networks of irrigation canals, while dams constructed at Hindiyah on the Euphrates and at Kut on the Tigris serve to divert the rivers into forked channels and increase the area under irrigation.

North of this alluvial plain, the country gives way to undulating uplands with an average elevation of about 1,000 feet. The river valleys are more sharply defined and sometimes confined within narrow gorges. The land between the rivers in this region is mainly steppe or gypsum desert and is known, as in Syria, as the Al Jazira. Toward the north and the northeast, the valleys of the Tigris and its tributaries are encircled by lofty mountain ranges, with peaks rising to from 10,000 to 15,000 feet, which form part of the Kurdish highlands, straddling the boundaries between Turkey, Iran and Iraq. The entire southwestern half of the country, from the Euphrates to the southern and the western frontiers, is gravel or sandy desert, a portion of the Great Syrian Desert.

132 The climate of Iraq varies with the topography, but in general it is characterized by hot, dry summers and cold, damp winters. Most of the rainfall is concentrated in the months from November to April, with the maximum precipitation during January and February. It averages 4 to 6 inches a

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63:Simmons et al G-5 (1941-1951) 1954
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As in other countries, all gradations in housing, between the palatial homes of the wealthy and the congested hovels of the poor, are found in the cities. Brick and cement are the usual building materials, although stone is widely used in Mosul and other towns in the north. In Baghdad, Arabic and Turkish styles of architecture predominate in the older sections of the city; modern villas, in the newer residential developments. Basra is a composite of 3 townships: Basra City, a typical Arab town; Ashar, the business community; and Margil, the new town and port center. In the oil field areas, housing estates are maintained by the operating companies for the benefit of their workers.

ENVIRONMENT AND SANITATION

Water Supplies

Water supplies are reasonably plentiful in the inhabited portions of the country. In the highland areas of the north and the northeast, water is obtained from streams, springs or wells, but in the alluvial plains, where the rainfall rarely exceeds 2 to 6 inches, it is taken entirely from rivers, canals, lakes or wells. Water is scarce in the desert regions but is available in some localities from waterholes, dug in dried stream beds, or from occasional permanent deep wells. The well waters in the mountain districts are sometimes highly mineralized, while shallow well supplies in the lower delta are generally brackish.

The domestic water supplies are treated before distribution in the larger cities and towns, but throughout rural Iraq they are unprotected and frequently polluted. The municipal water supply for the city of Baghdad is pumped from the Tigris River at 4 stations—3 on the left bank and 1 on the right. The entire supply is treated by sedimentation and chlorination, while filtration plants are also operated in connection with the pumping stations at Karrada and Sarrifiya, on the left bank. It is piped to individual service connections in all sections

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of the city, except in some of the poorer districts, where community taps are installed. The construction of additional plants for the treatment of the water supplies in the surrounding towns was planned in 1952. 312 364

At Basra, the water supply for the 3 townships and some of the adjacent villages is taken from the Shatt al Arab. It is treated by filtration and chlorination at Jubailah before distribution to suitably located storage tanks, from which it is piped to individual houses and community taps. The municipal supply of Mosul is derived from the Tigris River and treated by filtration and chlorination. River supplies are utilized by the capital cities of all the provinces, except Erbil and Sulaimaniya, on the northeastern border, where adequate spring sources are available. Treated water is furnished by the Iraq Petroleum Company to its installations in the vicinity of Kirkuk, and a portion of the supply is delivered by the company to the municipality. In the various cities the drinking water supplies are supervised by the municipal authorities. Bacteriologic examinations are made periodically in the laboratories of the government health services. No control is exercised over the smaller supplies, however, except when gross pollution is suspected. [744]

The waters of the Tigris and the Euphrates rivers have been utilized for irrigation for centuries, and the existing ruins appear to indicate that the ancient systems were more extensive than those in use today. Pumps and more primitive types of lift irrigation predominate, but other methods are employed along the course of the rivers, including tidal flow irrigation on the Shatt al Arab and free flow irrigation in the lower delta. In the northern provinces, local irrigation systems, fed from underground conduits which tap springs in the foothills and are connected by series of wells, are found in many areas. These *karez* are comparable with the *qanats* of northern Iran. 312

Several large-scale projects have been undertaken for the purpose of regulating

63:Simmons et al G-5 (1941-1951) 1954
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312 and controlling the flow of the rivers. By the construction of the Hindiyah dam on the lower Euphrates in 1913, part of its flow was diverted through the Hilla canal and secondary channels, thus opening up over 650,000 acres for irrigation in the western delta. A parallel barrage at Kut, on the Tigris, which was completed in 1939, permitted the forking of the river through abandoned channels and ultimately will bring almost 1 million acres under irrigation. A dam on the Diyala River provides water for the irrigation of about 260,000 acres in that valley. Other projects, designed for flood control, irrigation and sometimes hydroelectric power purposes, are under construction, or planned, for the Great Zab, the Little Zab and other rivers. The enlargement of Habbaniya Lake, west of Baghdad, into a reservoir to control the flooding of the Euphrates and to furnish water for expanded irrigation facilities has been completed recently, while the conversion of the Wadi Tharthar depression, in the Al Jazira region, into a reservoir for the storage of the flood waters of the Tigris was
653 in process of construction in 1952. A Gen-
312 eral Development Board was created by the Iraqi government in 1950 to review its various development programs, including irrigation, communications, medical institutions and other public services. Since its inception, the Board has underwritten extensive projects for the development of domestic water supplies and irrigation.

Waste Disposal

314 There are no municipal sewerage systems in Iraq. In the cities, cesspits are commonly employed for the disposal of sewage, although water-borne systems, connected with septic tanks, are installed in some of the modern homes, hotels and public buildings. The contents of the cesspits are usually carted to dumping grounds on the outskirts of the towns. In the smaller towns and villages, sewage disposal is by means of pit privies or cesspits. However housetops, courtyards and other convenient sites often

southern provinces and has been held responsible for sporadic outbreaks of dengue fever. It is also a potential vector of urban yellow fever, although that disease is not reported from this region. Many varieties of Culex mosquitoes have been recorded, but none has been specifically implicated in the transmission of disease. *Culex quinquefasciatus* (= *C. fatigans*) or *C. pipiens* (each a potential vector of *Wuchereria bancrofti*) is present in most areas.

Within recent years extensive mosquito control work has been undertaken by municipal and government authorities, by the oil companies and, during World War II, by the British Expeditionary Forces. The problem is stupendous, involving the improvement and the regulation of the irrigation facilities on which the agricultural economy of the country depends. In 1947, malaria control was first attempted on a nation-wide basis with the creation of an antimalaria service within the Iraqi health organization. Since that date, control operations have been carried on in various highly endemic areas. Depending upon local conditions, they have included antilarval measures, drainage works and residual spraying of the rural villages with DDT preparations. In 1952, a demonstration DDT house-spraying program was initiated in the hyperendemic Tanjero Valley of Sulaimaniya *liwa* (province), in conjunction with the World Health Organization.

FLIES. Flies are prevalent in all parts of the country. Numerous species of MUSCIDAE are encountered, many of which are implicated in the mechanical transmission of intestinal and eye diseases. *Musca sorbens* and *M. domestica vicina* are most frequently incriminated, but *M. tempestiva*, *M. vitripennis* and *M. mesopotamiensis* are also abundant. The larvae of *Fannia canicularis* sometimes cause myiasis in the livestock. The stable fly, *Stomoxys calcitrans*, is almost ubiquitous. At least 22 species of *Tabanus* are recorded, and many local authorities believe that they are involved in the mechanical transmission of anthrax.

164 361 369 Basra to 75 per cent at Al Qurnah, in the fork between the rivers. In Muntafiq, the mean rate was 47 per cent, and in Diwaniya, 26 per cent, although some districts were heavily infected and others practically free. In central Iraq the disease was more irregular in distribution. In Baghdad *liwa* the infection rates averaged 35 per cent, but approached 80 per cent in some localities. In Kut, the mean was 48 per cent, with a decrease in prevalence toward the Iranian frontier. In Hilla, it was 15 per cent, with variations from 5 to 50 per cent, and in Kerbela, 28 per cent, with variations from 18 to 48 per cent. In the areas studied in Diyala *liwa* it ranged from 28 to 60 per cent, and in Dulaim it approximated 36 per cent. Subsequent surveys have revealed 11 to 18 per cent infection in limited foci near the marshes in Mosul *liwa*.

164 361 369 742 In a survey conducted in Baghdad in 1950-51,[57] ova of *S. haematobium* were found in 25 per cent of the urine samples collected from 285 schoolchildren and in 46 per cent of the samples from 242 inhabitants in hut settlements on the outskirts of the city. The prevalence was around 20 to 25 per cent in the suburbs, but reached 83 per cent in foci along the main road to Teheran.

164 462 Indigenous cases of *S. mansoni* infection have not been reported, but numerous cases of rectal involvement with *S. haematobium* have been observed. A dermatitis produced by nonhuman schistosome cercariae is common in the south and is often responsible for considerable disability among the agricultural workers.

164 462 ● 312 744 Schistosomiasis constitutes one of the most important disease problems in Iraq. It is of major public health and economic significance, and the possibility of its spread with the expansion of irrigation is a matter of considerable concern to the government authorities. An active schistosomiasis control program is carried on by the Bilharzia Section of the Department of Endemic Diseases. This section maintains snail destruction and treatment units in the affected

provinces, and conducts research and field investigations on the distribution and the control of the disease and the intermediate snail host. In the 7 years 1944-50, from 15,800 to 27,300 persons were treated annually in government hospitals and dispensaries. The disease is considered commonplace in most areas, however, and probably not over 5 to 6 per cent of the infected individuals seek treatment under ordinary conditions. Since 1949, special dispensaries have been established in Baghdad, Basra and Kufa, while mobile clinics tour the most seriously infected districts. In 1950, there were 11 mobile units for the treatment of schistosomiasis, malaria and hookworm infection among the rural populations.

ANCYLOSTOMIASIS. Ancylostomiasis is widespread in the irrigated areas, but the exact distribution and severity of the infection in the different provinces are not accurately known. *Ancylostoma duodenale* is the only species found in the foci studied. The infection rates are generally estimated at 10 to 20 per cent in the northern provinces and at 40 per cent in the southern. They are especially high in the Amarah and the Al Qurnah regions, but decrease toward the south, and are relatively low in the districts along the Shatt al Arab. In a study reported in 1939,[47] fecal specimens from apparently healthy men, 18 to 20 years of age, from various parts of the country were examined for hookworm ova. The presence of ova was detected in 25 per cent of the specimens from 125 men from Baghdad and in 46 per cent from 135 men from the rural districts of Baghdad *liwa*. Comparable examinations revealed ova in the specimens from 26 per cent of the individuals examined from Diyala *liwa* and from 25 per cent of the individuals from Dulaim. The degree of infection is usually mild, but serious cases with hemoglobin indices as low as 10 per cent are not infrequent.

Treatment facilities are provided by the schistosomiasis control units, as well as by the government hospitals and dispensaries.

63:Simmons et al G-5 (1941-1951) 1954
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tendances in the hospitals and the dispensaries in 1950, ranged from 26 to 266 per 1,000 population. They approached, or exceeded, the mean rate of 111 per 1,000 in 6 *liwas*, being 106 in Diyala, 111 in Diwaniya, 155 in Erbil, 158 in Sulaimaniya, 205 in Hilla and 266 in Kerbela. While such statistics provide rough indices of the present prevalence of the disease, they contribute little to our knowledge of the extent of the problem.

The northeastern mountain districts and the irrigated zones along the Shatt al Arab and the lower Euphrates are the most highly malarious sections of the country. Differences in the average rate of endemicity, as shown by spleen surveys among children 2 to 10 years of age, are indicated on the following map,[41] in which the principal malarious regions are arbitrarily grouped according to the factors governing the transmission of the disease. Malaria is hyperendemic in the date-growing areas along the Shatt al Arab (I), which are watered by a complex system of tidal irrigation. In Basra, Fao, Al Gurnah and the chief towns, the spleen rates approximated 75 per cent in 1941, but were reduced to about 12 per cent by 1949 as the result of control operations. The rate of infection is relatively low in the marshlands of the southern delta (II), where *Anopheles pulcherrimus* predominates, but foci of greater prevalence exist as far north as Qalat Saleh. In Amarah and other towns, the spleen rates are estimated at about 8 per cent. In the lower Euphrates basin (III), the annual flooding of the river and the extensive system of gravity-flow irrigation from high-level canals create conditions favorable to the breeding of the vector species, *A. stephensi*. The spleen rates usually average 30 to 60 per cent, but in controlled localities, as Hilla, Kerbela, Nasiriyeh and Suq ash Shuyukh, they had declined to around 20 per cent in 1950. In the upper Euphrates valley, north of Ramadi (IV), however, irrigation is limited to small-scale projects employing pumps or more primitive meth-

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63:Simmons et al G-5 (1941-1951) 1954
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Malaria in Iraq. Regional Endemicity[41]

[312] [312] ods for lifting the water from the deep river channel, and malaria is only mildly endemic. The spleen rates in Hit, Anah, Hadītha and such typical towns approximate about 4 per cent. Lift irrigation is also employed in the middle Tigris region (V). The spleen rates are generally low, although scattered foci of endemicity exist where conditions are suitable for the breeding of *A. stephensi*. In Baghdad and other towns the spleen rates are normally about 3 per cent, but epidemics sometimes result when other species invade the agricultural areas from neighboring foci to the north. An outbreak in which *A. sacharovi* was implicated was reported in 1946-47 in the vicinity of Baghdad. A sharp outbreak also occurred in 1947 in a district north of the city, when the infection was transmitted by *A. superpictus*. Malaria is endemic, as well as epidemic, in the gravity-irrigated zones of the lower Diyala basin (VI), but a low level of infection prevails in the districts near the junction of this river with the Tigris. Spleen rates of 20 to 50 per cent are found throughout much of the area, approaching nearer 90 per cent in uncontrolled villages around Baqubeh.

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63:Simmons et al G-5 (1941-1951) 1964
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SUMMARY

Iraq encompasses the valleys of the Tigris and the Euphrates rivers, and is associated historically with Mesopotamia, the home of one of the oldest civilizations on record. It has been an independent sovereign state since 1932. The population, which was estimated at 4,799,500 in 1947, is 95 per cent Moslem and predominantly Arab. Extensive petroleum resources and date cultivation contribute to the wealth of the country, which is still relatively underdeveloped in other respects. The public health activities of the Iraqi government are centralized in the Ministry of Health, with headquarters in Baghdad. The Ministry is responsible for the maintenance of preventive and curative services, which are carried out in the provinces through subordinate provincial organizations. Municipal departments exist in Baghdad and the principal cities, but in other areas the enforcement of sanitary regulations devolves upon the government officers. In 1950, there were 82 civilian hospitals in the country, with an aggregate capacity of 4,901 beds, or slightly more than 1 bed per 1,000 population. Almost one half of the total beds were located in the Baghdad area. Approximately 82 per cent of the hospitals are supported by the government. Also in 1950, 433 dispensaries were functioning in various parts of the provinces, 403 under the jurisdiction of the government health authorities.

The water supplies in the towns and the villages of the alluvial plain are derived from rivers, canals, lakes and wells; in the northern highlands, from streams, springs and wells. All the urban supplies are obtained from rivers, except in Erbil and Sulaimaniya, where spring sources are utilized. The water supplies of the larger cities are treated, but those in the rural areas are unprotected and often polluted. There are no sewerage systems. In the cities, cesspits and septic tanks are employed for the disposal of sewage; in the rural villages, the means are more primitive. The dietary

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67: United Nations S-5 (1945-1954) 1955 MI Middle East
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Chapter 4

IRAQ

Developments to the End of the Second World War

433 At the end of the First World War, when Iraq was constituted as a State, 312 very little had been done to develop its economy. An over-all irrigation 315 programme had been drawn up, and the Hindiyah barrage had been built on the Euphrates and work begun on the Habbaniyah escape channel, but the outbreak of war had interrupted progress. The war had also prevented the exploitation of oil deposits by the Turkish Petroleum Company, formed in 1914. In the nineteen twenties, development was started. The digging of canals, the building of minor [496] works and the installation of irrigation pumps resulted in a substantial increase in cultivation, and there was also a slight improvement in farming methods. Railways were extended and other means of transport improved.

436 Further steps were taken in the nineteen thirties. In 1932, instead of the 312 rupee, the Iraqi dinar became the unit of currency. The Kut barrage, on the 433 Tigris, and various canals, regulator dams and minor projects were completed. 652 The establishment of a few cotton gins, textile plants and other factories 423 producing consumer goods marked the beginning of modern industry. A government-owned Agricultural and Industrial Bank was set up. A land settlement law was passed in 1932 and amended in 1938, and work on land settlement began in 1933.

471 Of more importance to the Iraqi economy was the development of the petroleum 382 industry. In 1925, the Iraqi Petroleum Company, a successor to the Turkish 315 Petroleum Company, was granted a concession, and in 1927 the Kirkuk oilfield was 651 discovered. By 1934, that field had been brought into production, and two 652 pipelines, with an annual capacity of 2.2 million tons each, had been laid to the Mediterranean coast; these developments required an investment of $62 million. Exports of oil began that year. The royalties and other revenues from petroleum accruing to the Government greatly increased its receipts and made it possible to augment expenditure on economic and social development.

433 During the Second World War Allied troops stationed in Iraq spent large sums on local purchases; from 1941 to 1944 inclusive, these expenditures totalled £64 million. There was a corresponding increase in national income, expressed in monetary terms, and prices rose considerably, the wholesale price index reaching a peak of 590 in 1943 (December 1938 to August 1939 = 100) and standing at 503 in 1945. This addition to national income and rise in prices stimulated agriculture; the area under cultivation was considerably extended, by irrigation and greater use of farm machinery, and although yields declined, total output increased somewhat. The greater part of the Allied expenditures was saved, in the form of sterling balances, which, in July 1947, amounted to £57.9 million. 1/

1/ National Bank of Iraq, Annual Report, July 1949-December 1950 (Baghdad, 1951).

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433 The increase in oil production and other earnings of the Board resulted in a higher revenue during the years 1951/52 to 1953/54 than that originally estimated, in spite of a smaller withdrawal from the $12.8 million Wadi Thartar project loan granted by the International Bank for Reconstruction and Development. In the meantime, the Board's over-all expenditure during the same period amounted to about ID 40 million, including loans and advances; accounts deposited with the National Bank of Iraq for the disbursement of the Thartar project; and the sum of ID 10.5 million paid to the Ministry of Finance for the schemes undertaken by the various ministries on behalf of the Board (see table 32). Furthermore the Board has authorized government departments to finance various plans on its behalf, and has awarded several contracts for its major plans to various foreign and national companies. Some of these plans have already been completed and the rest are to be completed in the next few years. Thus the actual expenditure plus the obligated expenditure of the Board have been estimated to be about ID 45 to ID 55 million.

The most important reasons for deferring the expenditure of the allocated amounts provided for in the Board's budgets since its operation have been the delay in the approval of the programme by Parliament; the inability of the different departments, particularly in the first two years, to execute the projects entrusted to them by the Board; and the necessity for providing adequate time to study, survey and prepare the estimated cost and specifications for inviting tenders for the various projects. Most of the projects outlined in the original programme needed further studies and surveys, several of which have since been completed. Many have been submitted by various engineering consultants of international repute, and are under consideration by the Board. The Board hopes to accelerate the execution of such projects as were planned since it has almost reached the end of the planning stage.

Major projects

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433 One of the main purposes of the Six-Year Plan is to control floods in the Tigris and Euphrates by storing surplus water which can be used for irrigation. An over-all programme has been prepared, at an estimated cost of ID 335 million, providing for the construction of ten dams; 1/ it is expected to increase the cropped area by 75 per cent and raise net annual agricultural income from its present level of ID 62 million to ID 222 million; part of this programme is being implemented under the Six-Year Plan. The plan also provides for industrial expansion, the building of 3,500 kilometres of metalled roads and improvement of a further 3,000 kilometres.

1/ See Knappen, Tippets, Abbott and McCarthy, Report on the Development of the Tigris and Euphrates River Systems (Baghdad, 1954).

67: United Nations S-5 (1945-1954) 1955 Mi Middle East
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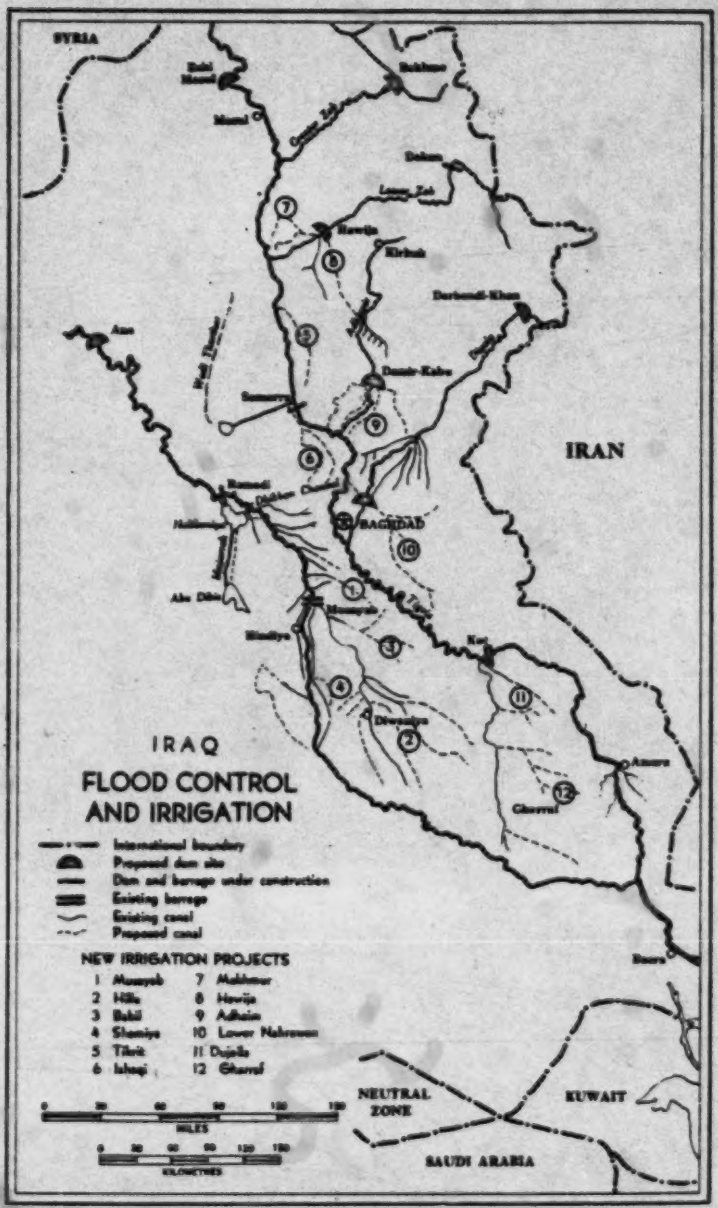

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312 185 433 There are several other projected dams and barrages on the Tigris and its tributaries (see map). The dam on the Tigris near Baki Mosul is estimated to have a capacity of 8 billion cubic metres and to cost ID 16 million. The Bekhme dam, on the Greater Zab, will have an initial capacity of 3 billion cubic metres and an ultimate capacity of 8.3 billion; its costs are estimated at ID 21.8 million and ID 39.6 million, respectively. The dam would provide irrigation for 625,000 hectares and a capacity of 600,000 kilowatts of electric power.

Two projects are planned on the Diyala, another tributary of the Tigris. A dam at Derbendi-Khan would have a storage capacity of 3.7 billion cubic metres and would increase the water supply for 309,000 hectares at present receiving light irrigation; its costs are put at ID 21 million. Preliminary work has begun. A barrage at Bani Saad, costing ID 1.75 million would, when complemented by the Makrawan irrigation works, provide water for 223,000 hectares. In addition to the Dokan dam, a barrage is to be built on the Lesser Zab, at Hawija; it could irrigate 50,000 hectares. The Gharraf scheme will channel water from the projected Baki Mosul or Bekhme dams to 429,000 hectares in the Amara region. Another project, falling outside the Six-Year Plan, is a dam at Damir Kapu, on the Adhaim river, providing irrigation for 175,000 hectares, as well as electric power.

The total area which will be irrigated by the various projected schemes on the Tigris and its tributaries was estimated at 1.24 million hectares, and that by the Euphrates schemes at 560,000 hectares, a total of 1.8 million hectares. Work is also proceeding on the drainage of 233,000 hectares, and the Six-Year Plan provides for an expenditure of ID 25 million for land reclamation, agricultural research, afforestation, improvement of animal husbandry, filling swamps and marshes and various other schemes.

433 185 Industrial development plans aim at both increasing the output of consumer goods and utilizing Iraq's petroleum resources to produce certain basic products. A cotton spinning and weaving factory is under construction near Mosul; it will have 20,000 spindles, thus doubling the present capacity 1/ and is expected to produce 20 million square metres of cloth per annum; a sum of ID 3,115,000 has been allocated for the project. 2/ Some expansion and improvement is also taking place in the privately owned woollen and rayon industries. 3/ Cement plants are being built, or planned, by both the Government and private enterprise. The Government is setting up factories at Mosul and Sarchinar, with a daily capacity of 350 tons each; completion is scheduled for 1956 and costs are estimated at ID 2.20[illegible],000 and ID 3,115,000, respectively. 4/ In addition, a privately owned plant at Mosul with a capacity of 350 tons a day is scheduled for completion by [illegible] another privately owned plant, near Baghdad, is doubling its present capacity of 800 tons a day, and a third private plant, with a daily capacity of 700 tons, is to be established near Hindiya barrage. 5/ The completion of all

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1/ Salman, loc. cit.; existing capacity is privately owned.

2/ The Iraq Times, 5 February 1955 (Baghdad).

3/ Al Shaab, 28 February 1954 (Baghdad).

4/ The Iraq Times, 5 February 1955 (Baghdad).

5/ Ibid., 26 January 1955.